DOCUMENT RESUME

ED 054 329 VT 012 103

TITLE Summer Institute in Agricultural Mechanics Education, Southern Region, Proceedings (Blacksburg, Virginia, August 3-7, 1970).

INSTITUTION Southern Regional Education Board, Atlanta, Ga.; Virginia Polytechnic Inst. and State Univ., Blacksburg.

PUB DATE Aug 70

NOTE 136p.

EDRS PRICE EDRS Price MF-$0.65 HC-$6.58

DESCRIPTORS *Agricultural Education, *Agricultural Engineering, Conference Reports, *Educational Objectives, Electricity, Speeches, Summer Institutes, *Teacher Education, Vocational Agriculture, *Vocational Agriculture Teachers, Welding

ABSTRACT

This summer institute emphasizes the establishment of minimum measurable standards of attainment in agricultural engineering phases of teacher education in agriculture. Speeches presented are: (1) "Where We Are in Agricultural Mechanics Education," by Alfred H. Krebs, (2) "Research Offerings for More Effective Teaching in Agricultural Mechanics," by John H. Rodgers, (3) "Changes in Agricultural Engineering That Will Affect Teaching in Agricultural Mechanics Education," by G.E. Henderson, (4) "Teacher Education in Agricultural Mechanics--Its Role in the Future," by George W. Wiegers, Jr., (5) "Identifying Instructional Areas in Agricultural Mechanics," by William C. Boykin, Sr., (6) "Trends in Vocational Agriculture and Agricultural Mechanics Education," by H.N. Hunsicker, (7) "Preparing Educational Objectives, Defining Affective Goals, Evaluating the Usefulness of Objectives, Analyzing Performance Problems," by Robert F. Mager, (8) "Appropriate Terminology for Agricultural Mechanics Education," by Carlton E. Johnson, and (9) "Suggested Courses in Agricultural Mechanization for Agricultural Education Graduates on the College Level," by Roland R. Harris. Appended are an evaluation, summary, and task force reports for metals, soldering, electricity, arc welding, gas welding and cutting. (FM)

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

**PROCEEDINGS**

# *Summer Institute in*
# AGRICULTURAL MECHANICS EDUCATION
## *Southern Region*

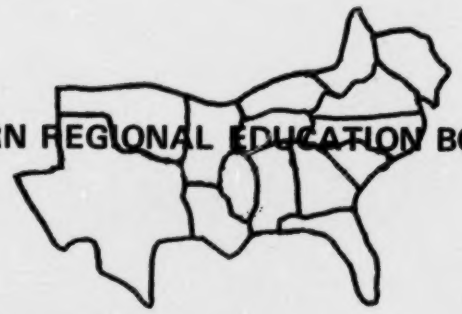
ED054329

Virginia Polytechnic Institute
and State University

Donaldson Brown Center For Continuing Education
Blacksburg, Virginia 24061

**AUGUST 3 - 7, 1970**

Conducted Cooperatively By:




and

The College of Agriculture and
The Departments Of
Agricultural Engineering and
Agricultural Education at
Virginia Polytechnic Institute
and State University

VT012103

ED054329

TABLE OF CONTENTS

Program . . . . . 1-3

Program Participants . . . . . 4-7

Foreword . . . . . 8
Dr. T. J. Horne, Project Director, Agricultural Sciences

Institute Overview . . . . . 9-11
Prof. T. J. Wakeman, Institute Chairman

Where We are in Agricultural Mechanics Education . . . . . 12-24
Dr. Alfred H. Krebs

Research Offering for More Effective Teaching in Agricultural Mechanics . . . . . 25-33
Dr. John H. Rodgers

Changes in Agricultural Engineering That Will Affect Teaching in Agricultural Mechanics Education . . . . . 34-36
Mr. G. E. Henderson

Teacher Education in Agricultural Mechanics - Its Role in the Future . . . . . 37-46
Dr. George W. Wiegers, Jr.

Identifying Instructional Areas in Agricultural Mechanics . . . . . 47-58
Dr. William C. Boykin, Sr.

Trends in Vocational Agriculture and Agricultural Mechanics Education . . . . . 59-63
Mr. H. N. Hunsicker

Preparing Educational Objectives . . . . . 64-70
Defining Affective Goals
Evaluating the Usefulness of Objectives
Analyzing Performance Problems
Dr. Robert F. Mager

Appropriate Terminology for Agricultural Mechanics Education . .71-91
Dr. Carlton E. Johnson

Suggested Courses in Agricultural Mechanization for Agricultural Education Graduates on the College Level . . 92-97
Dr. Roland R. Harris

Institute Summary - "It's Decision Time" . . . . . 98-101
Dr. T. J. Horne

Closing Remarks . . . . . 102
Prof. T. J. Wakeman

Report of Task Forces

Introduction . . . . . 103
Dr. James A. Scanlon

Task Force Reports . . . . . 104-128

Evaluation and Suggestions for Future Institutes . . . . . 129-131
Dr. Carl E. Beeman

Conference Evaluation Summary Donaldson Brown Center
for Continuing Education . . . . . 132-133
Barbara Bryant

PROGRAM

INSTITUTE CHAIRMAN - T. J. Wakeman, Va. Tech.
SECRETARY - Robert A. Wall, Va. Tech.

EMPHASIS: Establishing Minimum Measurable Standards of Attainment in Agricultural Engineering Phases of Teacher Education in Agriculture.

MONDAY AFTERNOON & EVENING, AUGUST 3

2:00 - 5:00 Registration (Lobby)
5:30 - 6:30 Reception (North Lounge)
8:00 - 9:00 Meeting of Planning Committee and all Task Force Chairmen

TUESDAY MORNING, AUGUST 4

Presiding - J. P. H. Mason, Jr., Va. Tech.
Recorder - George Cook, Oklahoma State University

9:00 INVOCATION - W. C. Boykin, Alcorn A & M College
WELCOME - Karl T. Hereford, Va. Tech.
WELCOME TO THE DONALDSON BROWN CENTER - J. L. Hargis, Va. Tech.
INSTITUTE OVERVIEW - T. J. Wakeman, Va. Tech.
9:30 OUR PRESENT SITUATION IN AGRICULTURAL MECHANICS - A. H. Krebs, Va. Tech.
10:15 Recess
10:30 WHAT RESEARCH HAS TO OFFER FOR MORE EFFECTIVE TEACHING OF AGRICULTURAL MECHANICS - John H. Rodgers, Clemson University
11:30 Questioning of Speakers
11:45 Lunch

TUESDAY AFTERNOON, AUGUST 4

Presiding - C. J. Rogers, University of Florida
Recorder - Curtis Shelton, University of Tennessee

1:00 CHANGES IN AGRICULTURAL ENGINEERING THAT WILL AFFECT THE TEACHING IN AGRICULTURAL MECHANICS EDUCATION - G. E. Henderson, University of Georgia
1:45 Reactors - F. W. Nicholas, Virginia State College; R. C. Butler, West Virginia University
2:15 TEACHER EDUCATION IN AGRICULTURAL MECHANICS - ITS ROLE IN THE FUTURE - George W. Wiegers, Jr., University of Tennessee
2:45 IDENTIFYING INSTRUCTIONAL AREAS IN AGRICULTURAL MECHANICS FOR THE INSTITUTE - W. C. Boykin, Alcorn A & M College
3:15 Adjourn

TUESDAY EVENING, AUGUST 4

Presiding - Lloyd P. Jacks, Murray State University

8:00 TRENDS IN VOCATIONAL EDUCATION PARTICULARLY IN AGRICULTURAL MECHANICS EDUCATION AS DIRECTED BY THE VOCATIONAL EDUCATION ACT OF 1968 - H. N. Hunsicker, U. S. Office of Education
Questioning of Speaker

WEDNESDAY MORNING, AUGUST 5

Presiding - J. P. H. Mason, Jr., Va. Tech.
Recorder - G. L. White, Auburn University

8:15 PREPARING EDUCATIONAL OBJECTIVES - Robert F. Mager, Mager Associates, California

10:15 Recess

10:30 ESTABLISHING MINIMUM STANDARDS OF ATTAINMENT IN AGRICULTURAL MECHANICS EDUCATION - James A. Scanlon, University of Arkansas

11:30 Organize Task Forces for Work Sessions and designate assignments. Introduction of Consultants and discussion of their functions. T. J. Wakeman, Va. Tech.
Walter A. Cameron, Ohio State University, (Consultant)
Phil Teske, U. S. Office of Education, (Consultant)

TASK FORCES

I. Metals (General, hot & cold)

C. J. Rogers, Ch.
George White, Rep.
Carl E. Beeman
George Cook
Howard Downer
Roland Harris
Curtis Shelton
John Bishop

II. Soldering (Soft & hard)

Robert T. Benson, Ch. & Rep.
R. C. Butler
Roland Espenchide
J. A. Hardy
Eldon E. Heathcott
K. D. Cook

III. Gas Welding & Cutting

F. W. Nicholas, Ch.
R. E. Powell
L. L. Crump
Ron Seibel
Lewis Eggenberger
Waverly Brown
Dean Sutphin

IV. Electricity

W. C. Boykin, Ch.
Hollard Randell, Rep.
G. H. Hetzel
M. E. Singleton
Lloyd P. Jacks
G. E. Henderson
Steve Bell
C. B. Jeter
Curtis Corbin
James T. Craig

V. Arc Welding

Carlton Johnson, Co-Ch.
Charley Jones, Co-Ch.
D. N. Bottoms
Robert Derden
Henry E. Foster
Everette Prosise
Robert Sutphin

WEDNESDAY AFTERNOON, AUGUST 5

Presiding - J. P. H. Mason, Jr., Va. Tech.

1:00 Task Force Sessions - (Meet in rooms assigned)
2:10 Recess
2:30 Reassemble in Auditorium: Progress reports from the Task Forces; Comments from the Consultants.
3:20 Tour of Va. Tech Campus

THURSDAY MORNING, AUGUST 6

Presiding - D. N. Bottoms, Auburn University

8:00 Task Force Sessions (Meet in rooms assigned)
10:00 Recess
10:20 Reassemble in Conference Room G: Progress Report from the Task Forces, Comments from the Consultants
11:50 Lunch

THURSDAY AFTERNOON, AUGUST 6

Presiding - D. N. Bottoms, Auburn University

1:10 Task Force Sessions - (Meet in rooms assigned)
2:10 Recess by groups
2:30 Task Force Sessions - (Meet in rooms assigned)
3:30 Reassemble in Conference Room G: Final Reports from the Task Forces; Comments from the Consultants.
4:00 Adjourn

FRIDAY MORNING, AUGUST 7

Presiding - W. C. Boykin, Alcorn A & M College
Recorder - James A. Scanlon, University of Arkansas

8:00 APPROPRIATE TERMINOLOGY FOR AGRICULTURAL MECHANICS EDUCATION - Carlton Johnson, Ohio State University
9:00 Questioning of Speaker
9:20 SUGGESTED COURSES IN AGRICULTURAL MECHANICS FOR AGRICULTURAL EDUCATION GRADUATES ON THE COLLEGE LEVEL - Roland Harris, University of Georgia
9:50 Questioning of Speaker
10:00 Recess
10:20 EVALUATION AND SUGGESTIONS FOR FUTURE INSTITUTES - Carl Beeman, University of Florida and C. B. Jeter, State Board of Education, Virginia.
10:40 USING MULTI-MEDIA IN AGRICULTURAL MECHANICS INSTRUCTION FOR EFFECTIVE LEARNING - James W. Sloan, Westinghouse Learning Corporation, Maryland.
11:30 Institute Summary - T. J. Horne, Project Director, SREB, Georgia

PROGRAM PARTICIPANTS

Beeman, Carl E.
Assistant Professor
Dept. of Agricultural &
Extension Education
University of Florida
Gainesville, Florida 32601

Bell, Steve
Associate Professor
Agricultural Engineering Dept.
Virginia Tech
Blacksburg, Virginia 24061

Benson, R. T.
Agricultural Material Specialist
Vocational Education Media Center
Clemson University
Clemson, South Carolina 29631

Bishop, John M. (Student)
Dept. of Agricultural Education
Virginia Tech
Blacksburg, Virginia 24061

Bottoms, D. N.
Teacher Trainer
Agricultural Mechanics Dept.
Auburn University
Auburn, Alabama 36830

Boykin, W. C.
Head Teacher Trainer
Agricultural Education Dept.
Alcorn A & M College
Lorman, Mississippi 39096

Brown, Waverly E. (Student)
Dept. of Agricultural Education
Virginia Tech
Blacksburg, Virginia 24061

Bryan, Billie
Head, Agric. Engr. Dept.
University of Arkansas
Fayetteville, Arkansas 72701

Butler, R. C.
Head Teacher Trainer
Agricultural Education Dept.
West Virginia University
Morgantown, West Virginia 26506

Cameron, Walter A.
Research Coordinating Unit
Clemson University
Clemson, South Carolina 29631

Cheatham, J. M.
Associate Professor
Agricultural Engineering
Agricultural, Mechanical, &
Normal College
Pine Bluff, Arkansas 71601

Clark, Hylton
Agriculture Teacher
James Wood High School
Winchester, Virginia 22601

Cook, George
Teacher Trainer
Dept. of Agricultural Education
Oklahoma State University Campus
Stillwater, Oklahoma 74074

Cook, K. D.
Agriculture Teacher
Lebanon High School
Lebanon, Virginia 24266

Corbin, Curtis (Jr.)
Agricultural Education
Teacher Trainer
College of Education
Baldwin Hall
Athens, Georgia 30602

Craig, James T.
Dept. of Agricultural Engineering
Clemson University
Clemson, South Carolina 29631

Crump, L. L.
Assistant Teacher Trainer
Agricultural Education
Alabama A & M University
Normal, Alabama 35762

de Porry, Andre C.
Dean, School of General Studies
University of Virginia
Charlottesville, Virginia 229[illegible]

Derden, Robert H.
Dept. of Agricultural Education
Tennessee State University
1611-23rd Avenue, N.
Nashville, Tennessee 37203

DeVore, Jack
Dept. of Vocational Education
University of Arkansas
Fayetteville, Arkansas 72701

Downer, Howard I.
Assistant Professor
Agricultural Education Dept.
The University of Tennessee at Martin
Martin, Tennessee 38237

Eggenberger, Lewis
Associate Professor
Texas Technological College
Dept. of Agricultural Education
P. O. Box 4169
Lubbock, Texas 79409

Espenchied, Roland
Assistant Professor
Agricultural Engineering Dept.
College of Agriculture
University of Illinois
Urbana, Illinois 61801

Foster, Henry E.
Agriculture Teacher
Franklin County High School
Rt. 1, Box 118
Rocky Mount, Virginia 24151

Gordon, A. G.
Itinerant Teacher Trainer
Agricultural Mechanics Education
Alcorn A & M College
Alcorn College Rural Station
Lorman, Mississippi 39096

Hardy, J. A.
Assistant Supervisor
Agricultural Education
210 Crowell Building
Pulaski, Virginia 24301

Hargis, J. L.
Associate Director
Program Development
Donaldson Brown Center
Virginia Tech
Blacksburg, Virginia 24061

Harris, Roland
Associate Professor
Agricultural Engineering Dept.
University of Georgia
Athens, Georgia 30602

Heathcott, Eldon E.
Teacher Trainer
Agricultural Education
Dept. of Agriculture
Murray State University
Murray, Kentucky 42071

Henderson, G. E.
Coordinator, AAAE & VA
Agricultural Engineering Center
University of Georgia
Athens, Georgia 30601

Hereford, Karl T.
Dean, College of Education
Virginia Tech
Blacksburg, Virginia 24061

Hetzel, Glen H.
Instructor
Agricultural Engineering Dept.
Virginia Tech
Blacksburg, Virginia 24061

Hollandsworth, Martha
Institute Secretary
Virginia Tech
Agricultural Engineering Dept.
Blacksburg, Virginia 24061

Horne, T. J.
Project Director
Graduate Education in the Ag. Sciences
Southern Regional Education Board
Atlanta, Georgia 30313

Hunsicker, H. N.
Chief, Agricultural Education Service
Division of Vocational & Technical Education
U. S. Office of Education
Dept. of Health, Education, & Welfare
Washington, D. C. 20202

Jacks, Lloyd P.
Head Teacher Trainer
Agricultural Education
Murray State University
Murray, Kentucky 42071

Jenkins, D. A.
Agriculture Teacher
Loudoun County High School
Leesburg, Virginia 22075

Jeter, C. B.
Assistant Supervisor
Agricultural Education
State Board of Education
Richmond, Virginia 23216

Johnson, Carlton
Teacher Trainer
Agricultural Engineering Dept.
Ohio State University
Columbus, Ohio 43210

Jones, Charley
Agricultural Education Dept.
The University of Martin at Martin
Martin, Tennessee 38237

Krebs, A. H.
Head, Agricultural Education
Virginia Tech
Blacksburg, Virginia 24061

Mack, W. O.
Dept. of Earth & Plant Sciences
P. O. Box 125
Florida A & M University
Tallahassee, Florida 32307

Mager, Robert F.
Mager Associates
13245 Rhoda Drive
Los Altos Hills, California 94022

Mason, Jr., J. P. H.
Head, Agricultural Engineering Dept.
Virginia Tech
Blacksburg, Virginia 24061

Newcomb, L. H.
Agriculture Teacher
Dublin High School
Dublin, Virginia 24084

Nicholas, F. W.
Assistant Professor
Dept. of Agricultural Education
Virginia State College
Petersburg, Virginia 23806

Phillips, Larkin
Agriculture Teacher
Chilhowie High School
Chilhowie, Virginia 24319

Powell, R. E.
Assistant Supervisor
Agricultural Education
Agricultural Engineering Center
Room 603
Athens, Georgia 30601

Prosise, Everette
Instructor
Agricultural Education Dept.
Virginia State College
Petersburg, Virginia 23806

Randell, Hallard
Agricultural Mechanics Specialist
Oklahoma State Dept. of Vocational
& Technical Education
1515 West Sixth Avenue
Stillwater, Oklahoma 74074

Rogers, C. J.
Teacher Trainer
Agricultural Engineering Dept.
University of Florida
Gainesville, Florida 32603

Scanlon, James A.
Teacher Trainer
Vocational Education Dept.
University of Arkansas
Fayetteville, Arkansas 72701

Seibel, Ron
Agricultural Engineering Dept.
University of Maryland
College Park, Maryland 20742

Shelton, Curtis
Assistant Professor
Agricultural Engineering Dept.
P. O. Box 1071
University of Tennessee
Knoxville, Tennessee 37901

Singleton, M. E.
Assistant Professor of
Agricultural Engineering
Agricultural Ed. & Mech. Dept.
Box 276, The Fort Valley State College
Fort Valley, Georgia 31030

Sutphin, Dean (Student)
Agricultural Education Dept.
Virginia Tech
Blacksburg, Virginia 24061

Sutphin, Robert L. (Student)
Agricultural Education Dept.
Virginia Tech
Blacksburg, Virginia 24061

St.John, William P.
Agriculture Teacher
Chilhowie High School
Chilhowie, Virginia 24319

Teske, Phil
Division of Comprehensive &
Vocational Education Research
U. S. Office of Education
Washington, D. C. 20202

Wakeman, T. J.
Professor
Agricultural Engineering Dept.
Virginia Tech
Blacksburg, Virginia 24061

Wall, Robert A.
Assistant Professor
Agricultural Education
Virginia Tech
Blacksburg, Virginia 24061

White, G. L.
Specialist, Agricultural Mechanics
Auburn University
Auburn, Alabama 36830

Wiegers, Jr. George W.
Head, Agricultural Education Department
University of Tennessee
Knoxville, Tennessee 37916

Yates, L. A.
Assistant Professor of
Agricultural Engineering
North Carolina Agricultural &
Technical State University
Sockwell Hall
Greensboro, North Carolina 27411

# FOREWORD

Since its inception in 1956 the Council on Higher Education in the Agricultural Sciences has provided leadership in planning and implementing programs designed to further develop agriculture in the Southern region. In accordance with its primary purpose, the Council is guiding an SREB project supported by the W. K. Kellogg Foundation, planned to advance the land grant institutions, agriculture and the agricultural sciences.

To effectively plan and implement the activities involved in the project, the Council membership was organized into four subcommittees, with each assigned to work with a major objective of the project. Subcommittee no. 2 headed by Dr. Coyt T. Wilson, Associate Dean and Director, Research Division, Virginia Polytechnic Institute and State University, formulated program recommendations to develop faculty in the sciences important to agriculture.

This institute in Agricultural Mechanics Education was a recommendation of this subcommittee. The concept of the institute was fully supported by the Council and the agricultural mechanics faculties of the region as a means of further developing faculty competence. The work of this institute may well constitute a milestone in improving instruction in agricultural mechanics for the procedures developed with the participants in writing attainable objectives in behavioral terms could revolutionize instruction in these courses in the region. This publication of the proceedings of the institute entitled, "Writing Educational Objectives for Agricultural Mechanics in Behavioral Terms," is being made available to participants and other faculty members in the region to use as a guide in further developing objectives for their programs of instruction. Developing such objectives constitutes the first step in a complete reorganization for an improved program of education in agricultural mechanics in the region.

T. J. Horne, Project Director
Agricultural Sciences

# INSTITUTE OVERVIEW

T. J. Wakeman
Department of Agricultural Engineering
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia

Some years back I met Dr. Horne in the hallway. He was in somewhat a dejected mood. He was then Assistant Dean of Agriculture and he felt, at that time, that some of us in Agricultural Education were dragging our feet. He said, "Until my dying day I am going to help promote and bring dignity to Agricultural Education." This Institute is another effort of Dr. Horne's here to serve with us and this group of people in Agricultural Education. As you know, Dr. Horne is Project Supervisor of the Southern Regional Education Board, our sponsor for this Institute.

Next I want to mention Phil Mason, Head of our Department of Agricultural Engineering here at Virginia Tech. He will be presiding on several occasions and I would like to add that it was because of his interest that we asked him to preside. I want to say he is one of the most progressive individuals I have ever known in my 36 years of activity in Agricultural Mechanics. Along with all the other tasks he has helped plan this Institute from the beginning. He is an inspiration because he wants quality teaching in depth. He is intelligent because he will change his mind if shown the facts. He is interested in modern methods and modern subject matter. He encourages looking into the future, too. You should have seen him helping us adjust our fume removing equipment. He is not antiquated nor is he set in his mind. This is the type of man we will hear more of during the Conference and in years to come in the field of Agricultural Mechanics Education.

Never in my experiences have I ever seen such an assembly of minds to do any job at hand as there is here to write objectives in Agricultural Mechanics for prospective teachers of agriculture. In a nutshell, we are here to write objectives about five subjects in Agricultural Mechanics, and we have a group for each section. Most members have been supplied subject analysis for each subject. You may not agree in the entirety with these, but this effort was made to prevent the loss of precious time debating about anything else except writing attainable objectives in these five subjects. We chose metals, arc welding, acetylene welding and soldering from the Farm Shop, or Agricultural Construction and Maintenance educational area as described in the Agricultural Engineering phases of "Teacher Education in Agriculture" pamphlet. That is four of the subjects. The fifth one was the educational area of electricity as it applies to the industry of agriculture, making the subjects a total of five. All of us are familiar with these subject matter areas and we are all aware that the Farm Shop section or Agricultural Construction and Maintenance is

basic to the other five areas. We realize that we can only make a good beginning with these five subjects selected. Many in this group can write objectives with a high degree of efficiency. However, when we go away from here, I am certain that with the help of Phil Teske, Bob Mager, Walter Cameron, Bob Benson, W. C. Boykin and all the rest of us that we will be able to do a better job. Let us not quibble over the subject analyses or any other item that will prevent us from obtaining our objective, to "write objectives".

To give us a background for this Institute we have a presentation entitled, "Our Present Situation in Agricultural Mechanics Education" by Dr. Krebs of Virginia Tech. Following that we have a paper being presented by Walter Cameron for Dr. John H. Rodgers of Clemson who could not be here due to terminal family illness. His paper describes what research has to offer for more effective teaching of Agricultural Mechanics. Then Tuesday afternoon G. E. Henderson, a stature in Agricultural Mechanics Education, will tell us of the changes in Agricultural Engineering that will affect the teaching of Agricultural Mechanics Education. At 2:15, Dr. George W. Wiegers, a giant in both Agricultural Mechanics and Agricultural Education, will tell us the role teacher education in mechanics has in the future. Then at 8:00 o'clock Tuesday evening, H. N. Hunsicker of the U. S. Office of Education will speak on "Trends in Vocational Education Particularly in Agricultural Mechanics Education as Directed by the Vocational Education Act of 1968." Then Wednesday morning first on the program will be Dr. Robert Mager, a world figure in writing educational objectives.

I feel we do not realize what we have in store for us in Dr. Mager, Dr. W. C. Boykin, Dr. James A. Scanlon, Dr. Walter Cameron and Dr. Phil Teske. All these men are nationally known figures. They were chosen because we wanted to give you the best help in starting this move that is possible. Writing educational objectives is the everyday opportunity for each of these men, not one or two of them, but all of them. I know we will leave here inspired to go home and write objectives for each of our classes. From my own experience I can tell you it has reduced teaching time one-third and increased effectiveness 100 percent over the conventional ways of teaching that all of us will eventually give up. Our youth need this type of "rifle purpose" teaching rather than the shotgun method.

We have you divided into task forces to practice writing objectives. You will only get started, but you can say to our co-workers in education we have started to do what you have been doing and what industry and the armed forces are doing now.

Dr. Bottoms will preside Thursday. Dave has contributed in unknown terms to Agricultural Mechanics Education. Whenever I needed help during the past 25 years, I would call on Dave - and here at our Institute you will find Dave giving of his best which is superb. The task force room assignments are on the mimeographed sheet. Let this be a day of work!

Friday, our great promoter in the person of W. C. Boykin and who has given so much to this program will preside. Dr. Carlton Johnson will give us his paper on Appropriate Terminology. Carlton has been working on definitions in this area for years and I know this will be a great contribution. Following this will be a presentation by Roland Harris entitled, "Suggested Courses in Agricultural Mechanics for Agricultural Education Students on the College Level." Roland has spent a lot of time getting this material together and it will be good. It will be worth each state adopting. I hope the Agricultural Education Department heads will profit by his good advice.

After recess we will have an evaluation report from Carl Beeman and C. B. Jeter. These men have a magnificent device prepared for evaluating the Conference. Please follow their instructions. Dr. Sloan was moved to California and could not be with us. We will find many items to fill in here. Then we have at 11:30 the Institute Summary by Dr. T. J. Horne, Project Director, Southern Regional Education Board. He will advise us as to what the future may be relative to future Institutes.

Now I turn to Dr. Mason who is presiding, but let us keep in mind our objective here is to learn to start writing objectives.

# WHERE WE ARE IN AGRICULTURAL MECHANICS EDUCATION

Alfred H. Krebs, Teacher Education
Department of Education
Virginia Polytechnic Institute and State University
Blacksburg, Virginia

The emphasis for this meeting is on the development of statements which will verbalize minimum standards of attainment in agricultural mechanics for college students preparing to become teachers of agriculture. You will hear from experts on graduate instruction, instructional media, terminology, areas of instruction, trends, teacher education, objectives, and research. Each will make a contribution to the problem at hand. Frankly, I felt you should hear, to set the stage for these expert presentations, an address by an agricultural engineer. You know, however, that fish never discovered water. So it may be that a non expert can help you experts discover the decisions which must be made to arrive at solutions to problems in the agricultural mechanics phase of teacher education in agriculture. My comments will focus on where we are in agricultural mechanics education in three areas of concern for this conference: objectives, content analysis, and college teaching.

## Some Personal Observations

Before we get into a discussion of the main points of my topic, let's set the stage by taking a brief look at our total agricultural mechanics education program.

One place where we can look is at the performance of our product on-the-job in the high school. As usual, we will see much that is good and a little that is not so good. Most of what we see can be found somewhere in every state, with the good, hopefully, being more prevalent than the bad. Here are some examples of what we would see:

1. Students working in only one area of agricultural mechanics for four years. (These students may belong in the trades and industry program).

2. Students building a beef feeding rack, a wagon, or a self feeder for hogs.

3. Students repairing a combine.

4. Students repairing a small engine or overhauling and painting a tractor.

5. Students assembling farm machinery.

6. Students assembling a pre-cut cedar chest or making a gun rack.

7. Students never getting beyond running beads in welding or never getting beyond soldering together two pieces of copper metal. (Basically, this is a skills oriented approach to teaching rather than the application we stress.)

8. Students doing excellent work and some doing very poor quality work.

9. Students practicing sawing, boring holes, or doing nothing.

10. A well-kept shop and a cluttered, unsafe shop.

11. Dull, broken tools and no tools at all.

12. Teachers struggling to teach that which they haven't mastered.

13. Adults doing metal lathe work.

14. A teacher specializing in agricultural mechanics in a multiple teacher department.

15. Semester courses in small engines, tractors, electricity, welding, construction, or machinery. (How far should we go with this kind of specialization?)

16. Agricultural mechanics in technical schools and community colleges.

17. Teachers lacking ability in basic shop skills.

18. Teachers spending half to ninety per cent of their time teaching in the shop.

19. Enrollments in agricultural mechanics courses second in size only to enrollments in production agriculture courses.

20. Teachers unable to apply the principles they were taught because the relationship to the world of work had not been a part of the instruction.

21. Teachers uncertain regarding the best age for a youth to learn to perform various mechanical tasks.

We can also look to research for some insights into our programs. Since the contribution of research is being discussed later, I'll mention only that my limited follow-up of former students to determine their use of learnings on-the-job or for other purposes shows the use of agricultural mechanics learnings to be at or near the top when compared with the use of other agricultural learnings.

What would we see if we looked at our university teacher education programs in terms of agricultural mechanics? Here are some examples applying to both methods courses and to agricultural mechanics courses:

1. About one-tenth of course credits earned in agricultural mechanics.

2. Courses entitled "farm mechanics". (Are we still selecting tools, equipment, course content, and shop plans to meet only the needs of farmers?)

3. Courses in agricultural mechanics which fail to interest students and courses we can't keep students from taking.

4. Too much subject matter content squeezed into some courses and not enough in others.

5. Too much methodology of teaching in some agricultural mechanics courses and not enough in others.

6. A skills development emphasis in some courses; application of learning getting some attention in others.

7. Courses structured according to teaching specialities in agricultural mechanics or engineering; an occasional course structured to meet the needs of one of the agricultural education teaching options.

8. All students enrolled receiving the same instruction regardless of background.

9. Some developmental efforts at programmed instruction in mechanics content.

10. Some workshops and courses to help teachers keep up-to-date.

11. Reduction of emphasis on basic shop skills, particularly in hand tool and carpentry work.

12. Concern for coordinating preparation of teachers for community colleges, technical schools, and for secondary schools. (For such areas as diesel engines and hydraulics. decisions need to be made regarding what gets taught at each level so that decisions regarding teacher preparation can be made.)

13. Insufficient recognition of need for or of effort to develop mechanical judgment.

14. Little effort being made to develop certain off-farm agricultural mechanics occupations business abilities such as job cost estimation, management of a parts service, or buying and selling machinery and equipment.

I could continue, but you can add your own observations. We could improve teacher education in agricultural mechanics by making and analyzing observations of these kinds and revising our programs accordingly. What we see in our teacher preparation programs is reflected in our secondary and post secondary school programs, as the observations indicate. If we used these observations, at least we wouldn't be as far behind the needs of teachers as we are now, even though we would still be following instead of leading. If we are going to lead, we need to base our program development around procedures which will help us predict or anticipate. This is where a sound base in philosophy of agricultural mechanics education can help. My remarks regarding objectives, content analysis, and college teaching will be based on my observations both as to where we are and where we ought to be.

## Objectives

We have a tendency, at times, to expedite the solving of our problems by starting with what we wish to do and then developing a set of objectives to fit. This is why we get into some of the situations which so astonish the non-educator and why, perhaps, we stay so far behind the needs of teachers. We should always first try to define that which we wish to accomplish and then develop the program and procedures for accomplishing it. So it is that the beginning and end of the purpose of this conference could be the stating of some of the objectives for agricultural mechanics education for future teachers. These objectives are or could be the minimum standards of attainment mentioned before.

In formulating these objectives, or minimum standards of attainment, we will need to keep firmly in mind that we are indeed talking about the needs of a future teacher of agriculture. We are not trying to develop a highly skilled craftsman in a single skill or an engineer. We simply don't have the instructional time to do it and, of course, we have another vocational education program assigned that kind of responsibility. Our task is to prepare people in the area of agricultural mechanics. We will also need to keep in mind that minimum standards of attainment apply to more than the performance of motor skills. Both the cognitive and affective domains of educational objectives should also be included. Finally, we will need to keep in mind the mechanics tasks to be performed by the teacher for that which he teaches -- the full range of teaching options in agricultural education: production, forestry, conservation, ornamental horticulture, machinery services, processing and marketing, and other areas.

The formulation of objectives will be no simple task. It may be helpful to examine some of the characteristics of educational objectives.

### 1. Measurable

The expression "measurable educational objectives" is heard often. I suggest that this expression means that one should be able to state

the criteria or evidence to be accepted as indicating that the objective has been achieved. For example, an objective in the area of welding could be "to develop the ability to fasten two pieces of metal together with a butt weld using an arc welder." The criterion of success could be that the metal will break "outside the weld" when stress is applied. In this case, the "measure" is a determination by inspection of the location of the break -- if the material could indeed be broken. No pounds, inches, or other numerical score is implied. This objective could be expanded almost indefinitely by specifying thicknesses of metal to be used. We already use many of these kinds of objectives; we haven't done well in putting them into a useable written form.

Another objective might be the development of pride in doing a <u>good job</u> welding. How does one "measure" pride? In addition, there is the partially subjective judgment of just what represents a "good" job in welding. Some people are satisfied if a weld will hold; others insist on beauty in a weld as well as holding quality because of the alleged relationship between the two.

One of the major dangers here is that objectives such as these are isolated skill objectives. We still need objectives which require demonstrating application of skills to "world of work tasks".

Whatever the decision regarding the kind of "measure" to be accepted, it should be stated or described. Perhaps we should also be willing to accept as reasonable some objectives or minimum standards of attainment for which adequate means of measurement have yet to be developed as long as this is admitted.

2. <u>Stated in Behavioral Terms</u>

The term "behavioral" has also become a standard part of any discussion of educational objectives. I suppose objectives must be stated in behavioral terms because we are dealing with people and it is to the bringing about of changes in behavior that we have dedicated our efforts. We must always keep in mind, of course, that people exhibit many kinds of behaviors, some of which are much more easily observed than others. Not all of the teacher objectives in agricultural mechanics are "mechanical" and visible to the eye; some, as with pride in workmanship, must be seen as a by-product of visible activity. For the most part, this represents nothing new to us. We are masters at teaching for changes in behavior.

3. <u>Understandable</u>

Perhaps the term "reliability of meaning" could be used here. In any case, the objective or minimum standard of attainment must be so clearly stated that each of us would agree on its meaning. If this does not obtain for the objectives developed, the purpose of this conference will not be fully accomplished. It may be that we will want to work with the objectives developed and return next year to refine them based on that experience.

4. Within the Limits of the Subject Area

It seems necessary to point out that the accepted objectives should fall within the scope of the instructional area under consideration. Too often, claims are made for the accomplishment of objectives clearly outside the scope of a subject area or course in order to help justify what we want to do. Nationally, we have been on a science-status seeking kick. If we have nothing to teach that is different from other sciences, then we should eliminate the teaching of either agriculture or the other sciences. Some commonalities are, of course, to be expected and are acceptable.

5. Attainable

That the objectives should be within the reach of students seems also self-evident. However, since there are courses in which 50% and more of the enrollees fail, this characteristic deserves some attention. Our objectives should contribute to the development of capable teachers rather than to an increase in the academic dropout percentage. Some institutions are moving toward a policy of two grades -- pass and incomplete. A student does not pass a course until all the teacher objectives for the course are accomplished. The student decides whether he can afford the time and energy to complete the objectives for any particular course. This policy would require some extremely specific and well stated objectives.

6. Appropriate to the Enrollee's Objectives

Appropriateness is in reality repeating the earlier statement that we must remember that we are preparing teachers of agriculture who have needs related to a teaching speciality. The statements of minimum standards of attainment or objectives should relect this fact. A teacher does not need to be a highly skilled mason in order to teach laying block even though he may need to know more than the skilled craftsman about certain aspects of laying block. The objectives should focus on meeting the needs of the student, not on the needs of persons in related occupations. This point is becoming more important as teachers of agriculture prepare in greater numbers for specialization by options in vocational education in agriculture. The strength of vocational education in agriculture has always been in its breadth, not in an emphasis on single skill occupations.

One of the critical decisions we have to make is with regard to how far to go in preparing teachers for, and in the teaching of, such areas as engine overhaul, hydraulics, and electrical wiring. We can defend our position on the special application to agriculture up to a point. Already, however, administrators have asked why we can't combine tractor mechanics and automotive mechanics. This question must be answered with sound, educational reasoning.

7. Task Oriented

The objectives, or minimum standards of attainment, should be stated in terms of occupational tasks to be performed. We are in great danger in agricultural mechanics education of emphasizing isolated skills so much that students become able to perform a whole series of skills without learning to put the skills to use in a constructive sense. For example, we may have our students spend so much time in welding on "running beads" that he can make them beautifully but, at the same time, be unable to weld two pieces of metal together if those pieces happen to represent a part of a machine. I still remember one of my student teachers who had a terrible time doing actual electrical wiring. While being taught, he had to face a situation in which the wire was not visible for its full length while he was working on it.

8. Defined Conditions

The objectives must also define the conditions under which the behavior will be performed. Often, of course, the conditions are sufficiently clear as to require no specific elaborations. For example, in welding it is obvious that a welder would be required; it is not so obvious that an arc welder should be used. It is obvious that making a butt weld requires the use of two pieces of metal; it is not so obvious that this should be done also on a piece of equipment rather than only in a welding booth. It is also not so obvious that the conditions should reflect world of work conditions, not just laboratory conditions.

## Content Analysis

Many of you might well ask why I devote part of this time to a discussion on content. After all, this has been carefully treated in a report of an agricultural engineering education and research committee. But objectives indicate content and you can't have one without thinking about the other.

As you know, the report on the agricultural engineering phases of teacher education in agriculture identify five major areas. It is my understanding that a new area in agricultural engineering, food processing, has been added since the report to which I refer was prepared. We now have the following:

Farm Power and Machinery
Structures and Environment
Soil and Water Management
Electric Power and Processing
Agricultural Construction and Maintenance (Farm Shop Work)
Food Processing

While I believe that these broad general categories are not as mutually exclusive as they should be and need re-thinking, it is about the fifth category that I wish to take issue. It appears to me that the fifth category is an artificial one, created to serve the special interests of agricultural education. The other categories, although no longer adequate either, were at least based on an analysis of the agricultural engineering subject matter area. Let's examine this hypothesis by taking a critical look at each of the 17 objectives listed for the "Agricultural Construction and Maintenance" area.

The first five objectives in the "Agricultural Construction and Maintenance Area" contribute to a common purpose, and are, therefore, presented as a group.

1. Promote the establishment of a home farm shop or farm service center.

2. Supervise and assist in planning, equipping, arranging, and managing a school agricultural mechanics shop.

3. Select hand and power tools and shop equipment for the school agricultural mechanics shop and home farm shop, including makes, models, sizes, quantities, and grades.

4. Sharpen, repair, maintain, and safely use the common shop tools and equipment.

5. Install, safely use, service, and maintain power tools found in the agricultural mechanics shop.

These first five objectives all relate to the establishment and maintenance of a school agricultural shop. They form a logical segment of knowledge in agricultural mechanics.

Objectives six, seven, eight, nine, ten, twelve and thirteen have much in common.

6. Do electric arc and oxyacetylene welding, including cutting, bronze welding, and hard surfacing.

7. Do hot metal work, including bending, shaping, and heat treating.

8. Do cold metal work, including cutting, drilling, filing, tapping, threading, riveting and bending.

9. Do sheet metal work, including cutting, bending and fastening.

10. Do pipe and tubing work and make simple plumbing repairs.

12. Supervise and assist with construction and maintenance of smaller farm buildings and equipment.

13. Do painting and glazing. Apply wood preservatives.

Each of these objectives represents abilities needed for, and should be listed under, both the area of "Farm Power and Machinery" and the area of "Structures and Environment".

Objectives eleven, fourteen, and fifteen belong to one group.

11. Select lumber, hardware, and other building materials and calculate bills of material.

14. Construct and maintain adequate farm fences.

15. Do concrete work including building forms, testing materials, preparing mixes, placing, finishing, and curing and laying concrete and masonry building units.

Each of these objectives relates only to the area of "Structures and Environment".

This leaves two objectives, sixteen and seventeen, yet to be examined.

16. Make the more important rope knots, hitches, splices, and halters.

17. Recognize dangers and hazards connected with the use of tools and equipment and guard against them.

Objective seventeen, on safety, is or should be a part of any teaching we do in any area. It must not be taught apart from the activities involving hazards of any kind or degree.

Objective sixteen appears to be an historical accident. There is little reason why this should be considered agricultural engineering, although it does no harm to do so.

The result of this analysis is that we still have six areas, but one of the areas is an agricultural shop establishment and maintenance area with five objectives -- six if we include safety as we should. All the remaining objectives apply to one or more of the first four phases of agricultural engineering. What has apparently happened is that certain laboratory or skill segments have been separated from their natural categories to comprise college level agricultural mechanics courses. This has led to the "skills" orientation of our college courses in agricultural mechanics about which I spoke in my opening remarks. This artificial separation of the skills from the major phases or content areas in agricultural mechanics may also have caused certain needed skills or abilities to be omitted. For example, the ability to estimate costs for welding jobs has been overlooked because of our emphasis on the skill of welding.

It seems to me that it would make more sense to take another look at the content groups we have been discussing and make certain that the major phases or areas are identified as they should be. In particular, the agricultural engineering phases of agricultural teacher education need to be restudied in the light of the rapidly changing high school agricultural education programs. The addition of a "foods processing" area represents progress. Environmental elements need to be added to each of the agricultural engineering areas identified, not just to the structures area. Consideration should be given to the addition of other areas. For teachers, the new teaching specialities (options) may provide some direction.

The objectives, if sound as listed, should then be grouped under each phase to which they apply even if they are listed more than once. This would provide a content analysis of agricultural engineering subject matter for use in planning properly for college teaching. Plans for teaching youth could then be made in terms of how best to teach in relation to the use of the abilities identified in the world of work. Laboratory work for "Farm Power and Machinery" would include the use of hot metal work and welding, as would laboratory work for "Structures and Environment". The laboratory work would be provided in conjunction with the lecture work. There would no longer be an artificial separation of certain "doing" objectives from "knowing" objectives. Our students would no longer be expected to determine the relationship between what we teach and the world of work all by themselves.

## College Teaching

The third topic about which I wish to speak briefly is college teaching. The relationship to content analysis is, of course, very close and has already been alluded to. The objectives are to be accomplished through teaching, thus making some consideration of teaching necessary if the objectives are to be stated in the most useful form.

As implied, planning for teaching begins with preparing, in the form of stated objectives, a detailed description of the kind of agricultural mechanics person -- for us, a teacher -- to be developed. The objectives indicate the content, and the content and objectives dictate the teaching procedures to be used.

If a teacher needs to be able to file a saw, it stands to reason that facilities for saw filing must be provided. This is a shop activity, based on certain items of knowledge which need to be learned first. If, in the power area, our description of a teacher includes the ability to time a tractor engine, then both shop and classroom learning are again needed. If, on the other hand, all that is needed is a knowledge of the procedures in each case, then no shop facility would be needed. Thus, it appears that we need to consider both "doing" and "knowing" aspects of our behavioral objectives.

The consideration of each objective in terms of "knowledge of" and "ability to do" aspects makes clear the teaching approach needed. It also carries a strong implication that the teaching for the knowing and the doing should take place at about the same time. Teachers need to accomplish some of both kinds of objectives. Most of the objectives listed for the "Agricultural Construction and Maintenance" phase are "doing" objectives requiring the use of shop facilities for teaching. However, it is because not <u>all</u> "doing" objectives in the agricultural engineering phases of teacher education have been so categorized that I take exception to the content organization in the report. In addition, the relationship between the "doing" aspects of objectives in the farm shop category and the "knowing" aspects of the objectives in the other agricultural engineering areas has been obscured, if not completely ignored. There appears to be no educational justification for not listing the "doing" objectives under the categories to which they relate, unless you wish to debate the need for teaching some welding twice -- once in a machinery laboratory and once in a structures laboratory. While we do make some compromises to achieve efficiency in college teaching, I submit that we should not compromise to the point of failing to accomplish our objectives. I suspect there is as much difference between welding applied to machinery and welding applied to structures as there is between other content items appearing in different courses. The teaching of generalizations or principles may be efficient in terms of use of time, but it assumes a greater capacity in students than they possess to apply the generality to a world of work task without help and I repeat, we have failed often to teach application of principles to the occupational task.

The point we need to keep in mind in organizing for teaching is that the objectives we have accepted are descriptive of a future teacher. To help the future teacher develop the skills identified, develop the ability to analyze individual learning problems, and develop the ability to establish and organize facilities for teaching, persons with high school teaching experience have been added to the agricultural engineering faculties in an agricultural education -- agricultural engineering capacity. It is probably to provide for best utilization of these men that the artificial grouping of objectives referred to earlier was done.

As with the objectives, staffing for teaching seems to be based on some weak premises. A closer look at this situation may help to clarify your task here in writing minimum standards of attainment, or objectives with criteria, for evaluation.

As a non-expert, it appears to me that there are at least three levels at which an agricultural engineer would teach.

Design and Development
Function
Installation, Operation, and Maintenance

The research type agricultural engineer would probably be most interested in the design and development area. I am sure our teachers don't need this amount of expertise. In any case, the teaching for this level would require the talents of the agricultural engineering major.

Our teachers do need knowledge of function in agricultural machinery and equipment. Teaching courses at this level for teachers of agriculture should be a team effort of the agricultural engineering major and the agricultural mechanics education staff member. For some kinds of equipment, this level of teaching should include installation.

The installation, operation, and maintenance level of teaching is the agricultural shop "physically doing" level and should be taught for teachers of agriculture by the agricultural mechanics educator. This holds true for all of the objectives requiring agricultural shop facilities, not just for a few selected objectives. This suggested teaching structure -- course and staffing -- would keep college teaching in this area relevant to the needs of teachers of agriculture. It would require an organization for teaching future teachers that would have coordinated laboratory and lecture instruction.

Just a word about college teaching as compared with high school teaching.

It is obvious to us that the teacher of agriculture needs certain skills in order to teach others to perform them. It is just as obvious that there have been developed no performance tests to administer to our college students to see if they come to us with the skills and knowledge we think they need -- and which would permit giving credit for a course without taking it. The careful stating of minimum standards of attainment might make this possible. However, the ability to weld does not necessarily mean the student also has the ability to teach someone to weld. The minimum standards of attainment must also make possible the determination of the ability to teach welding if we are to certify that he has that ability. This requires, at a minimum, the knowledge needed to explain the reasons for what is done in welding and the mechanical judgment that is necessary to judge the work of a welder. We have devoted too much time to preparing a skilled technician and not enough time to the development of the ability to teach another person how to perform the skill. The teacher is less in need of skill mastery than he is in need of mechanical judgment, knowledge of why to perform a certain way, and the ability to observe a learner and detect where his performance can be improved. Perhaps you should also decide what should be done in the pre-service program and what should be left for in-service graduate and non-credit programs.

## Conclusion

There is much more that could be said about each of the three topics chosen for this brief presentation. You have probably noted that most of my remarks relate directly to the observations of agricultural mechanics programs made at the start of this presentation. I limited the range of thought to those points that appeared to have a direct bearing on the development of statements of minimum standards of attainment. What ever progress is made to develop these standards will contribute significantly

to the preparation of capable teachers for the area of agricultural mechanics education. Your task is the development of minimum standards of attainment; but it is to be hoped that these standards or objectives will be considered in the light of criteria for determining accomplishment, in the light of the task of using them as a basis for structuring the teaching situation. To do this will be to enhance greatly your contribution to the teaching of agricultural mechanics education. In so doing, you will help to make sure that agricultural education will continue to be a growing, vital part of the total educational program for all youth and adults.

# RESEARCH OFFERINGS FOR MORE EFFECTIVE TEACHING IN AGRICULTURAL MECHANICS

John H. Rodgers*
Research Coordinating Unit
Clemson University

We are said to be in the midst of a revolutionary change in education which should continue throughout most of the remainder of this century. Within three decades, it is felt that we will have developed new concepts concerning education and a new vocabulary. For instance we will speak very little of teaching and a role of the teacher will be expressed as that of instructional agent, lesson designer, lesson programmer or instructional environment manager. Also we will not characterize learning as an activity of the student but rather as a way of indicating a change in the student's behavior.

You are already aware that we are talking more about exercising control over the instructional environment in such ways as arranging the scope, sequence and content of educational materials. In other words we are using instruction to denote the process and learning to denote the product. These ideas alone imply many changes during the coming years in educational procedure.

## Individualized Instruction

All of the foregoing remarks tend to point to the development of some system of individualized instruction. Although this is not a new term, it is taking on new meaning as we approach education with the help of multimedia. Past practices in education would take us back some years to the classroom composed of some 20 to 30 students spanning the age levels of 6-14. With so few children in the various grade levels it was necessary for the teacher to spend most of his or her time working with individual students and directing their preparation, recitation and evaluation. We recognize there were some distinct advantages for certain students in this environmental setting for learning. However, I am sure we have no intention of returning to this type of learning environment for students in the latter part of this century.

A later well-known attempt at individualized instruction was given impetus about fifteen years ago when Harvard's B. F. Skinner (16) advocated an educational technology built around the use of rather crude teaching machines. Although it was apparent that no particular magic could be attached to the machines themselves, some students had rather

---

Presented at the Summer Institute in Agricultural Mechanics Education, Southern Region at Virginia Polytechnic Institute, August 4, 1970.

*In the absence of Dr. John Rodgers this paper was read by Dr. Walter Cameron.

startling results with this type of approach to learning. Some of the linear programs developed for the teaching machines were soon put into book form and the programmed text was born. These programmed texts are still being used in many ways and by a variety of people and with some measure of success. However, they have not caught on in many of the public schools to the extent that was once envisioned. In fact, industry and the military forces have probably made the best use of programmed texts, perhaps because of the high degree of motivation on the part of many of the learners in these situations.

One of the latest systems for individualizing instruction involves the use of a computer and is appropriately called computer assisted instruction. There are many variations to the format of computer assisted instruction and many unanswered questions as to how effective it is and how effective it might be if put into general use. However, substantial resources are being invested in computer assisted instruction and many bright young professors in colleges of education see this as a sophisticated field of endeavor. This approach to providing instruction can be adapted to almost any subject matter area including agricultural mechanics.

One approach to using computer assisted instruction is called adaptive education. This term is rather descriptive of what the developers of the system attempt to do. Based upon the assumption that a person learns best if he is rewarded for correctness with his most preferred type of reinforcement, the developers of this system attempt to discern the learner's reward preference in advance of instruction and to provide him with a computer based program in which the information feedback is tailored to his psychological preference. Based upon the learner's immediate past history of responses the adaptive program of instruction determines what comes next for each learner according to a prearranged schedule. For example, if a student makes four or fewer correct responses out of the most recent ten there might be an indication for the need for branching into shorter teaching steps with perhaps more prompting during the process; whereas, eight or more correct responses out of the ten most recent problems would suggest movement on to a program with long strides through the computor presented content. The dynamic part of this adaptive mechanism is that the computer constantly updates its performance information about each learner by dropping off the learner's response to the tenth problem back as it adds on new performance information from a just completed problem. This approach to instruction can embrace either the deductive or the inductive strategy with equal success.

## Simulation in Education

There is common agreement that instruction consists of providing learning experiences. A learning experience is simply any response which an organism makes to a stimulus or the stimulus configuration. There are such simple learning experiences as learning to read gasoline signs or road signs, perceiving a book, or distinguishing a magazine from a hard back book, or comprehending what was read. Many of these learning experiences can be approached in a number of settings and under a number of conditions. Yet these experiences can be quite meaningful and accomplish

almost any given purpose provided students are carefully selected and fitted into the situation in which they best respond.

Let us think together for a few minutes about three distinct levels of learning experiences. There is the real experience with which we are all familiar, there is the simulated experience and there is a vicarious experience. Real experiences include such things as gathering data by interviewing, becoming familiar with a real automobile, learning to play golf on a golf course, or numbers of other things with which we are intimately acquainted. Simulated experiences are those which a learner does, for example, when he engages with other individuals trying to solve problems with data obtained from some mythical state or system and can probably be best exemplified by the games approach. Many of you are familiar with the simulated flight problem-solving device known as the Link Trainer. Working with models or in the medical field the various mock-ups which are used for teaching and for getting some experience would fall into this category of simulated experiences. Vicarious experiences are most commonly obtained through reading about somebody else's real experiences. For example, it is not uncommon for us to participate in a journey taken and described by someone else and from this we learn a great deal about the people and places visited without having been there ourselves. Now much of our learning takes place with a combination of these experiences, the real experiences, the simulated experiences and the vicarious experiences. For example, we can mention that a vicarious-real experience might include watching yourself on video-tape playback or in a movie, or on video-tape as a teacher. No one can deny the value of having a person observe himself in action as a teacher. There are many other combinations that you can think of that are common to our every day participation. We have heard a great deal about the advantages of real experiences and we're very familiar with the use of vicarious experiences in education. Now I think we should explore some possibilities through simulation.

According to Wing (2) simulation is defined as an imitation of real circumstances aimed at providing a learning environment, in other words, simulation is a technique by which the essential features of some object or process are abstracted and recombined in a model which represents the original and can be manipulated for the purpose of study or instruction. This definition produces both clarity and confusion, however these characteristics of simulation are suggested;

1. an object or a process is manifested

2. the properties of the object or process are abstracted

3. the abstracted properties of the object or process are combined into a model

4. the model of the system (object or process) is manipulated for study

It becomes clear that the above characteristics of a system under investigation must first be analyzed and then synthesized into a usable

package for further application. The confusion might be created by the indication that there is agreement upon the contents of the system which is applied or learned in the last step of the generation of the simulation.

Simulation has been found both convenient and effective for teaching in many of the areas of science and mechanics. You will note that our entire space exploits were developed through simulated experiences. We are aware of the impossibility of having someone go up to the moon and return prior to the first real experience involved. Success of the space program should indicate tremendous possibilities for educating youngsters on lower levels through the use of well developed simulated experiences.

Perhaps you are familiar with some of the newer simulation games which are on the market and hold real implications for education. These games are of interest to us because a game (simulation) is a kind of play upon life in general. It induces in a restricted and well defined context the same kinds of motivations and behavior that occur in the broader context of life where we play for keeps. Also, there are apparently certain aspects of games that essentially facilitate learning such as their ability to focus attention, their requirement for action rather than merely passive observation, their abstraction of simple elements from the complex confusion of reality, and the intrinsic rewards they hold for mastery. Coleman (4) has listed some rules for simulated games which might have implications for educational practices. These rules refer to certain normative and legal constraints upon behavior in real life. They are:

1. Procedural rules describe how the game is put into play, and the general order in which play proceeds.

2. Mediation rules specify how an impass in play is resolved, or a conflict of paths is resolved.

3. Behavior constraint rules correspond to the role obligations found in real life, and specify what the player must do and what he cannot do.

4. Goal rules specify both what the goals are and how the goals are reached.

5. The environmental response rule specifies how the environment would behave if it were present as part of the game and

6. the police rule specifies the consequences to a player for breaking one of the game's rules.

Simmel (14) reflects upon the importance of simulated learning experiences in the following statement: Games that people play over and over again are those which mirror important real life situations or problems, so that in playing a game a person can in some sense practice real life without having to pay real life consequences for his actions.

Designing Learning Experiences

Williams has described certain desirable characteristics of programmed instruction as follows:

1. Criteria developed for the selection of a unit

2. Assumptions and/or definitions made about the kinds of learners

3. Behaviorally defined objectives

4. Selection of an appropriate programming paradignm

5. Ordering and constructing items

6. Evaluation

Lysaught and Williams (9) have evolved a dynamic model of their design rationale for programmed instruction. They propose that the beginning programmer begin with unit selection and proceed through the succeeding steps in a circular fasion until he called into question again the first step, which was unit selection. This was to be done by planning objective feedback for each step of the process bringing into question each of the steps, in turn, as they were initially accomplished. Also, all the decisions and any proceeding step could be questioned as data became available.

It was hoped that the programmer would see and appreciate that programming instruction is first a process and second a product. They further hoped that instructors would program a unit of learning material and then become concerned with how to use it and continue to improve it. However, their experience indicated that most individuals in the training program did not appreciate the process involved as much as the instructors did, but rather tended to remain relatively satisfied and unchanged in their regard for this aspect of instructional design. In other words, they found most practicing teachers to be more product oriented than process oriented; therefore, we tend to retain what has been developed and do very little about changing the approaches, methods and materials involved in educating people.

In the program instruction model designed by Lysaught and Williams (9), the learning experience to be produced was given. In addition the ways in which a learner might interact with the experience were restricted by the very notions peculiar to programming. Lastly the experience was designed to be used by one learner at a time (with some notable exceptions, e.g., using a program on educational TV or in a large class where provision was made for some sort of feedback. Experience has shown that this approach to educating large groups has not been too successful).

The problem of designing a learning experience arises when an instructor becomes aware that a learner or a particular kind of learner has some need to demonstrate some rather specific learned behavior (s). Such learning

can come about in a normal progression of events. For example, the learner who has successfully completed one set of learning experiences and has demonstrated that he now can multiply two digit numbers by one digit numbers and the instructor and learner, hopefully, speculate as to how to multiply two digit numbers by two digit numbers. However, the learner may try and succeed or fail. If he fails, the instructor must diagnose and develop some learning experiences which he feels will lead the learner successfully from being able to multiply two digit numbers by one digit numbers to multiplying two digit numbers by two digit numbers and so on. Generally, the learning experiences are designed in a continuing developmental sequence through all of the combinations of multiplying numbers without too much regard for the learners involved. In other words one pattern is set up in textbooks to be followed for all learners in a classroom or in perhaps many classrooms involving learners with various levels of ability. As you know, these designs are incorporated into many of our texts and other available instructional materials. These instructional materials become the products with which we work in a process with which we are too often not appropriately concerned. However, professional minded instructors will consider very seriously whether or not the commercial material is adequate, appropriate and/or even sufficient to the needs of his learners. With adequate experience we can determine whether or not these materials are doing the job for which they were designed but the consequence of gaining such experience can leave a number of students without the behaviors which they were to have developed through the learning process. This can be circumvented to a great degree by instructors who have become useful critics of new instructional materials. Perhaps one of the best ways to become alert and critical of new instructional materials is through becoming involved in producing, improving, using and analyzing materials. This involves the adoption of a rationale and design for developing learning experiences.

There seem to be four recognized steps in the process of designing learning experiences. These steps consist of a number of sub tasks which are very essential to designing learning experiences that are effective in developing desired behavioral outcomes.

Step I: Developing the logical characteristics of the situation. Determining the logical characteristics of the situation consists of at least the following sub tasks:

1. Making assumptions about or defining the learners, including specific entry behaviors.

2. Developing operationally defined behaviors as outcomes

3. Determining and describing which of the three levels of learning experiences are appropriate and should be included as a part of the experience to which the student is subjected. (You will recall these three levels of experience are vicarious experiences, simulated experiences, and real experiences, also you are free to have any combination(s) of these experiences that might be appropriate to the situation.)

4. Selecting appropriate engagement modes (sensory). Will the student engage in the experience through the use of overhead transparencies, a textbook, or a sixteen mm. movie, educational TV, a lecture or blackboard demonstration, the use of models, mock-ups and other sensory material or a combination of these.

5. Devising definite and useful ways to provide feedback (a) to the learner, (b) to the instructor. (This task has proven to be one of the weak links in providing learning experiences to students; therefore, it is difficult for anyone to give too much advice on the best way of providing feedback. A great deal of attention should be given to this important task since the improvement of instructional material will depend a great deal upon the quality of feedback provided during the learning experience.)

6. Developing ways to analyze the feedback (a & b) so as to guide the learner as he progresses through the experience and provide ideas for possible revision of the learning experience.

Step 2: Producing the learning experience.

Step 3: Utilizing the learning experience.

Step 4: Analyzing and feedback.

It is needless to say that in order for a teacher to design effective learning experiences, he must have a good understanding of subject area content.

1) Bloom, B.S., Engelhart, M.D., Faust, E.J., Hill, W.H., and Krathwohl, D.R., Taxonomy of Educational Objectives: Handbook I, the Cognitive Domain, New York, Longmans, Green, (David McKay), 1956.

2) Boocock, Sarane S., and Schild, E.O., Simulation Games in Learning, Beverly Hills, Calif., Sage Publications, Inc. 1968.

3) Bower, Eli M., and Hollister, W.G., Behavioral Science Frontiers in Education, New York, Wiley, 1967.

4) Coleman, James S., "Social Processes and Social Simulation Games," in Simulation Games in Learning (See #2)

5) Cooley, W.W., and Glaser, R., "An Information Management System for Individually Prescribed Instruction," working paper No. 44, Learning Research and Development Center, University of Pittsburgh, 1968.

6) Gagne, Robert S., "Elementary Science: A New Scheme of Instruction," Science, 151, 49-53, 1966.

7) Glaser, R., The Education of Individuals, Pittsburgh, Pa., Learning Research and Development Center, University of Pittsburgh, 1966.

8) Gordon, A.K., Unit Eight: Home-Made Games, Chicago, Science Research Associates, 1968.

9) Lysaught, J.P., and Williams, C.M., A Guide to Programmed Instruction, New York, Wiley, 1964.

10) Mitzel, H.E., The Development and Presentation of Four College Courses by Computer Teleprocessing, Final report, Computer Assisted Instruction Laboratory, The Pennsylvania State University, June 30, 1967. Contract No. OE-4-16-010, New Project No. 5-1194, U.S. Office of Education.

11) Oettinger, A.G., and Marks, S., Run, Computer, Run, Cambridge, Mass., Harvard University Press, 1969.

12) Postlewait, S.N., "Planning for Better Learning," in In Search of Leaders, ed. G.K. Smith, Washington, D.C., American Association for Higher Education NEA, 1967, pp. 110-113.

13) Rath, G.J., Anderson, N.S., and Brainerd, R.C., "The IBM Research Center Teaching Machine Project," in Automatic Teaching: The State of the Art, ed. E.H. Galanter, New York, Wiley, 1959, pp. 117-30.

14) Simmel, George, "Sociability: An Example of Pure or Formal Sociology," in Wolff, Kurt (ed) The Sociology of George Simmel, Glencoe, Ill., Free Press, 1950.

15) Skinner, B.F., "The Science of Learning and the Art of Teaching," Harvard Educational Review, Spring, 1954, pp. 86-97.

16) Slinner, B.F., "Teaching Machines," Science, 128, 1958, pp. 969-77.

17) Tosti, D.T., and Ball, J.T., A Behavioral Approach to Instructional Design and Media Selection, BSD Paper Number 1, Observations in Behavioral Technology, Alberquerque, N.M., The Behavior Systems Division, Westinghouse Learning Corporation, 1969.

18) Tyler, R.W., "New Directions in Individualizing Instruction," in The Abington Conference, '67 on New Directions in Individualizing Instruction, Abington, Pa., The Conference, 1967.

19) Williams, C.M., Fishell, K.N., and Butzow, J., A Guide to Reviewing Research (tentative title) in preparation and editing to be published by Wiley.

20) Wing, Richard I., "Simulation as a Method of Instruction in Science Education," The Science Teacher, 35, 41-42, 1968.

# CHANGES IN AGRICULTURAL ENGINEERING THAT WILL AFFECT TEACHING IN AGRICULTURAL MECHANICS EDUCATION

G. E. Henderson
Agricultural Engineering Center
University of Georgia
Athens, Georgia

The spectacular changes in agricultural mechanization that have come about in the past fifty years causes a person to wonder what more could happen that would equal the happenings in that era. Still, it is evident that much is still happening and the prospects are that it will continue to happen for many more years to come.

The prophets of doom would have us think that our ability to produce food and fiber will soon be out-paced by our population increase. When you take the facts that are available as to our potential, it is evident that there is still much that can be done to reduce labor, reduce wastes, improve the effectiveness of fertilizer and insecticides, and to increase the efficiency and quantity of food production. While this is being accomplished, agriculture can do its part to improve our environment.

Since this subject has to do with agricultural mechanization only, let's take a look at examples of what is likely to happen in the immediate future. Later, we will examine the prospects for the more distant future. Then we will appraise how these changes affect the teaching of agricultural mechanics.

Apparently, irrigation is to be much more widespread than it is today. The self-propelled types of systems such as the pivot irrigation system, have greatly expanded what one man can do to control the application of water on his crops. This gives a farmer a very effective tool to control both quantity and quality of his field crops.

It looks like farm structures are destined for substantial changes. The prefabricated, clear-span buildings that provide great flexibility of space usage, are definitely on their way in.

There are two rather interesting new developments in farm structures. One is the balloon-type building which might prove very helpful for temporary types of storage. The other is a mobile-type of structure which is being used in Iowa at the present time as a hog farrowing unit. It enables a farmer to get into this specialized type of production almost as quickly as he can go to the distributor and haul one of these units to his farm. These have possibilities in many other types of livestock and poultry production.

---

A slide presentation, presented August 4, 1970, at the Summer Institute in Agricultural Mechanics Education, Virginia Polytechnic Institute, Blacksburg, Virginia.

34
637

The future of the internal combustion engine may be at stake but not in the immediate future. It looks like some worthwhile advancements may be made in improving efficiency and reducing the amount of pollutants resulting from combustion. There appears to be little in the way of other developments to crowd the internal combustion engine out of its present prominent position.

There appear to be no spectacular changes in the future of field machines outside of the usual year-to-year improvements. An exception is the development of new machines for specialized crops, especially in the harvesting area.

As we look at the more distant future, there are prospects for much more flexible, more powerful tractors than the largest ones we are using at the present time. Some are even predicting that the cab will be mounted on a boom so that the operator may remain in his cab and still shift it to the front, side or back of the tractor in much the same manner that linemen for power companies can adjust the position of the buckets they use for repairing power lines.

The use of a helicopter-hover craft is a distinct possibility for accurate application of chemicals, for seeding and possibly for fertilizing large fields.

There are prospects that crops with high market value and high labor demand may be concentrated into enclosed structures. Some predict that these may be buildings with several floors, while others predict that they will be enclosed field areas, the enclosure being something of the nature of a transparent plastic dome. Light application, insect and disease control and the entire environment will be controlled by the operator. A high degree of mechanization will be required.

Some predict even greater concentration of livestock into confined areas such as multi-floored, silo-type structures where one man has easy access to several hundred head. The environment is completely controlled and waste is flushed to a central collection point.

A major influence on the development of many of these ideas is the use of electric power. With the cost of electric power moving down and other sources of power moving up in price, this is bound to have an effect on the amount of it that is used and the design of equipment which can use the power to the best advantage. An example of this is the fly-wheel power unit that is being proposed for equipment that operates for two hours or less. One in which an electric motor starts a fly-wheel spinning in a vacuum container. The power from it is then used to transport the unit while it is away from the electric power source.

What has just been described is no doubt just a smattering of some of the developments in the next twenty to fifty years. But how do these affect the teaching of agricultural mechanics? Let's assume that in general we are doing an adequate job at the present time in meeting our teaching needs in the field of agricultural mechanics. If that is the case,

we would need to expand our teaching efforts in the field of electrical controls -- especially solid state -- motors and electrical uses of all types. It will also be important that students have a reasonably complete background on hydraulics as they apply to machine controls and drives.

It looks like accent on wood working can be reduced and replaced with emphasis on how to plan structures and facilities to meet changing agricultural needs. Most farm buildings will soon be available on a prefabricated basis.

It appears evident that additional emphasis will need to be placed on metals, plastics and concrete. It will be a matter of recognizing what constitutes quality, how they can be used to the best advantage and how to work them.

It looks like instruction on internal combustion engines and field machines might continue on about the same level.

Remember that this appraisal is based on the assumption that we are already doing an adequate job. That statement is subject to question. Frankly, it looks like we will need to catch up in meeting our present training needs and be alert to the new stresses in some of the areas that will develop if agriculture develops as is now anticipated.

# TEACHER EDUCATION IN AGRICULTURAL MECHANICS
# ITS ROLE IN THE FUTURE

George W. Wiegers, Jr., Head
Department of Agricultural Education
The University of Tennessee
Knoxville, Tennessee

This subject has been a real challenge to me. In trying to establish a point of departure, I felt somewhat like the hunter trying to shoot a duck flying overhead from a rapidly moving motor boat on a rough lake. Agricultural education is moving forward at a rapid pace and so is agricultural mechanics technology. Most of us in agricultural education have a better understanding of where we have been than of where we now are on the scale of events or where we will be towards the end of this decade.

This assignment caused me to become interested in thumbing through some old farm mechanics books. I was amazed to find that a great many books were written in the area of farm mechanics during the 1920's and 1930's and that some of our "new" ideas and concepts are not really new after all. The earliest book that I found was written by Brace and Mayne and is entitled Farm Shop Work, copyrighted in 1915. In this book, C. A. Prosser stated "The aim of the practical arts courses in agricultural communities should be to give the boy at least an elementary experience in every form of manual work required to make an independent and successful farmer on his home acres. Such training will make the farm more attractive. It will also equip the farmer for more successful work in agriculture, both because he is prepared to meet the everyday demands of his calling and because he is saved the time and expense of relying upon the village mechanic for much that the school should prepare him to do." In Crawshaw and Lehman's book, Farm Mechanics, 1922, the preface stated: "The types of work covered while primarily representing the common branches of mechanical activity required under rural conditions, are, in most cases, applicable to the requirements of the industry upon which each type has a bearing." It further stated: "The projects are selected from the standpoint of the practical application to the needs of the student." The next book, entitled Agricultural Mechanics, by Robert H. Smith, was copyrighted in 1923. The author stated the following: "The aim is not to make of the reader a plumber, carpenter, blacksmith, harness-maker, tinner or painter, but rather give him such essentials as these and other trades as will enable him to make satisfactory practical repairs of farm equipment and to construct new devices as will assist him in his work." Isn't it interesting that these statements were written approximately fifty years ago? I wish I could share with you more of what I have read in the various copies of old farm mechanics books, but time will not permit. We owe a great deal to these early leaders in agricultural mechanization, agricultural engineering and agricultural education for laying such a firm foundation in agricultural

---

Presentation made at the Summer Institute in Agricultural Mechanics Education, Southern Region, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, August 4, 1970.

mechanics education for us. We do not have to re-invent the wheel in agricultural mechanics education because of the pioneering work of these leaders.

It is generally understood that agricultural mechanics is one of the phases of the instructional program in vocational agriculture, but perhaps I should comment briefly on what we mean by teacher education. Teacher education is usually conceived as having broad dimensions in higher education. It embraces all the formal and informal activities and experiences provided by and through an institution to prepare persons primarily for teaching careers. Teacher education, therefore, embraces general education, professional education (such as agricultural education), and technical education (such as agriculture including agricultural mechanization). General education is justified on the grounds that a teacher education graduate should be educated to play the role of a human being, a person, regardless of his professional career and professional education on the grounds that he will provide leadership or service as a member of the educational profession. The technical education is justified because the graduate needs specialized study in a technology in order for him to learn what knowledge is needed and how to apply it in concrete cases. It is not the objective of this presentation to deal in depth with all three major aspects of teacher education. The scope of this presentation will be limited primarily to the professional aspects of agricultural education with application to agricultural mechanics.

Before we take a close look at the role of teacher education in agricultural mechanics eduation, we should think about the end products of our teacher education programs. In the past and present, we have considered graduates majoring in agricultural education as specialists when classified in the broad fields of agriculture and education. As an agriculturalist, the agricultural education graduate is unique or distinctive because he is qualified to design, implement and evaluate educational programs and as an educator he is unique or distinctive because he is knowledgeable and competent in one or more areas of agriculture.

Tremendous changes have taken place in both education and agriculture during the past quarter century. Some changes will have lasting value, while others will glow momentarily and then disappear like a footprint in sand. Let us hope that the turbulence and frustrations that have been occurring in vocational education at the national, state and university levels will result in improved vocational education programs that will ultimately reach more people and develop better trained people for the world of work. Hopefully, this will be accomplished through more efficient and effective ways than we have witnessed heretofore.

A few years ago, one of our leading agricultural teacher educators summarized some observations he had made concerning the planning of expanded vocational programs. He indicated that if certain conditions were to prevail, a few inferences would be in order. One is that the future teacher may need to be trained, first as a vocational educator, and secondly as an agricultural educator. Apparently, he considered the two as separate entities and that sequence was important. I look upon agricultural education as a type of vocational education or as one member of the family of vocational education. He apparently meant an "across-the-board" type of

vocational education which is general in nature, and agricultural education as being somewhat specific. Based on the same observations, he felt that the vocational teacher should be a generalist in his technical knowledge and a specialist as a vocational educator. Some positions in various occupations require this type of preparation, but not all of them do.

It appears to this observer that we may be moving toward the production of a graduate in agricultural education who will be more "across-the-board"-oriented in vocational education than at the present, but he will still have a specialty in agriculture. Some agricultural education training will likely give way to the "across-the-board" type of vocational training. In teacher education circles, you will likely hear more discussion today concerning the generalist in vocational education than you will about the specialist, but when the discussion focuses on teaching a technology such as agricultural mechanics, the emphasis shifts to the need for specialty training. Where and when will the agricultural education major get his training in professional education and a specialty?

At the Bachelor's degree level, steps may be taken to begin the process of developing a generalist in vocational education along with developing a specialty. Agricultural education majors at the undergraduate level are already receiving general (across-the-board) education in economics, sociology, biology, chemistry, mathematics, genetics and physics. They are also receiving "across-the-board" experiences in some areas of general professional education such as principles of education, educational psychology, educational sociology and others. They will likely continue to receive a considerable amount of training in agricultural education and technical agriculture, including agricultural mechanization. The new input may be "across-the-board" experience in vocational education which may take the form of a formal course or summer internship. These experiences will not be designed to improve competence in the technology, but to acquaint the major with the broader aspects of vocational-technical education.

At the Master's degree level, an option may be available to build on the foundations laid in the undergraduate degree program, namely, technical agriculture and professional education (general, agricultural, and "across-the board" vocational). For those who aspire to positions which are designed to serve the needs of people in two or more areas of vocational education, more emphasis will likely be placed on "across-the-board" experiences.

The next level, the specialist degree level, may have options similar to those in the Master's degree program. One option may permit an in depth study of a technical area such as agricultural mechanization with additional training in agricultural education and/or "across-the-board" vocational education or in selected vocational education areas. Again, for the person who desires to be a generalist in vocational education, an option may be available which will include little or no experience or training in a technical area or agricultural education per se.

At the Doctor's degree level, options will be available as in the specialist degree programs, but there will likely be a shift in emphasis. At this level, candidates will not likely increase their competence in a

technical area. One option may focus primarily on "across-the-board" vocational education experience with sub-options in administration, teaching and research. The traditional option in agricultural education may continue to be available but may include some "across-the-board" vocational experiences. The doctoral degree programs emphasizing "across-the-board" vocational education are getting a boost at present because of the grants awarded through EPDA which is supporting some broad leadership type programs.

In summary, agricultural education majors may get formal experience in agricultural mechanization at the Bachelor's, Master's and Specialist degree levels, but not likely at the doctoral level. For some, formal training in agricultural mechanization will cease at the end of the undergraduate program, and for others when the Master's or Specialist's degree is earned. Some of the courses and programs will be offered by the agricultural engineering department, some by the agricultural education department and others jointly by the two departments.

In teacher education, we are primarily concerned with producing significant changes in behavior of learners through designed learning experiences. This aim is just as appropriate for technical education programs as it is for professional education programs.

Being able to perform a task expertly is not the same as being able to teach the task expertly. The first is done by a technician while the latter is accomplished by a professional teacher. In teacher education in agricultural mechanics, the aim is to develop a professional teacher of agricultural mechanics who can use his expertise in helping individuals learn agricultural mechanics in integrated agricultural courses or programs, in separate agricultural mechanics courses or programs, and/or in formal or informal education for adults and others.

In what ways can teacher education in the future contribute to developing professional teachers competent in agricultural mechanics to provide leadership and service for individuals and groups in the following programs and levels?

1. General agricultural education at the elementary and secondary levels;

2. Vocational and technical agricultural education at the secondary and post-secondary school levels;

3. Formal and informal adult agricultural education.

One approach to projecting the role of teacher education in agricultural mechanics is to state the major functions of teacher education and then indicate how parts of these functions specifically relate to agricultural mechanics. The major functions are as follows:

1. Preservice or pre-employment training;

2. Inservice training;

3. Improving college education procedures;

4. Research;

5. Preparation of téaching materials;

6. Professional improvement;

7. Public relations.

Preservice or Pre-employment Training:

This function begins with the recruitment of high quality students to prepare them for teaching agricultural mechanics and ends with their placement in positions where optimum success is likely.

In the future, vocational agriculture teachers will be employed in a broader spectrum of pursuits. The need for persons trained in agricultural mechanics to fill varied types of positions will require the teacher education departments to offer multiple track curricula to meet their needs. A single track curriculum is not likely to fulfill all the requirements. Most agriculture teaching positions in high schools still require the teacher to be trained "across-the-board" in agriculture. He must teach agricultural mechanics along with plant science, animal science and other content areas. As long as agri-business is to be served, there will be a need for producing a vocational agriculture generalist teacher. In multiple teacher programs, it is possible for teachers to specialize to a greater extent than is possible in the one-teacher department. One teacher, for example, may be responsible for all the agricultural mechanics offered. At the post-high school level, specialization is the rule rather than the exception. Regardless of the positions available in agricultural mechanics, teacher education programs must offer preservice curricula which will provide the best possible experience for students preparing to teach "across-the-board" agriculture and/or agricultural mechanics as a specialty.

In some universities, it is now possible for students to pursue a dual or double major. One may be the typical agricultural education major and the other major may be in some technical agriculture field, such as agricultural mechanization. Changes in job opportunities and certification laws may make it possible for a person to become certified to teach a specialty without completing all the traditional requirements. Teacher educators should play a vital role in upgrading curricula and in helping to improve certification standards.

The agricultural engineering departments are expected to play a major role in insuring technical competence in agricultural mechanization. This role, however, should be shared partly by the agricultural education departments because the latter control the minimum amount of training in agricultural mechanization the prospective teacher may receive in the preservice training program.

In the preservice program, agricultural mechanics education will continue to be integrated in agricultural education courses and the theory and practice will be tested in student teaching or internship programs.

Teacher education should play a vital role in using educational innovations and new technology in the preservice training of the agricultural mechanics teacher.

The innovations include the following:

Team teaching

Differentiated staffing

Independent study

Individualized teaching and learning

Small group instruction (shop and classroom)

Flexible scheduling

Use of teacher aides

Non-graded program

Teaching the disadvantaged

The new technology includes using the following:

Video tape

Individualized instruction packages

Teaching machines

Various other educational media (film loop projection, microfiche projection, portable tape recording, overhead projection, etc.)

Inservice Training:

Inservice training programs to upgrade and update teachers' competence in agricultural mechanics have already proved their value. The inservice programs should be available to improve both subject matter competence in agricultural mechanics and the teachers' capability in demonstrating advanced teaching strategies and technology.

Inservice training to improve agricultural mechanics education should continue to be provided through various means such as the following:

Visits to new and experienced teachers

Graduate courses in agricultural education, agricultural mechanics and joint offerings

Short intensive training programs on the college campus and off the campus (usually non-credit)

This summer, our inservice training program at The University of Tennessee got a new lease on life from twenty scholarships provided by the Tennessee Federation of Production Credit Associations. Nineteen of the scholarship winners enrolled in the small gasoline engines course which was offered. Fewer of the teachers enrolled in two courses designed to improve their professional competence. The parallel courses in agricultural education emphasized the effective use of educational media and teaching the rural disadvantaged. The teacher education staff played a role in the program by securing the scholarship funds, selecting scholarship winners and arranging for the instructional program. The agricultural mechanization instructor worked closely with the agricultural education staff in surveying the teachers to determine instructional needs. The procedure followed this summer will likely be continued in the future.

Improving College Educational Procedures:

The competent beginning teacher of agricultural mechanics is a product of training provided by many college instructors. Special credit, however, goes to his instructors in agricultural engineering or mechanization and agricultural education at the college level and to the supervising high school or post-high school teachers of student teaching. There is ample room for close cooperation between the foregoing to develop a better product or graduate.

Staff members in agricultural mechanization have repeatedly shown an interest in learning better ways of delineating course objectives, learning new and better ways of teaching and in constructing evaluation instruments. Members of agricultural education staffs are in a unique position to help improve the quality of the teaching-learning process in agricultural mechanization and in other technical agriculture areas because of their training and experience. The agricultural education staff should be willing and is equipped to supply the needed expertise for those in agricultural mechanization who need and want such assistance. The agricultural education staff is also in a unique position to coordinate the efforts of those teaching agricultural mechanization at the college level with those teaching agricultural mechanics in high school or post-high school programs. Teacher educators can determine from local teachers the competencies they need in agricultural mechanics and then work with college program planners in developing programs to meet those needs. This type of feedback (or follow-up) will help eliminate some of the irrelevance that contributes to program weaknesses and even failure.

The Committee on Agricultural Education of the Commission on Education in Agriculture and Natural Sciences has indicated that agricultural education staff members have a knowledge of the teaching-learning process and have continuing contacts with agricultural subject matter specialists. They are, therefore, in a good position to be of assistance in improving teaching in the college of agriculture. It was suggested that leadership be exercised in several areas. I will try to relate their suggestions to teacher education and agricultural mechanization.

1. The teacher educator should exercise leadership in developing a positive attitude towards more effective teaching of agricultural mechanics.

2. The teacher educator should effectively apply theory to practice in his classroom at the highest level for effective teaching.

3. The teacher educator should take the leadership in developing workshops, symposiums, and retreats concerned with the improvement of college teaching of agricultural subjects such as agricultural mechanics.

4. The teacher educator should be available to his colleagues in agricultural mechanics as a consultant as new courses are developed and as existing courses are revised.

5. The teacher educator can provide a deeper impact on the improvement of instruction by providing a course in the improvement of college teaching or seminar in this area. Problems, examples, and illustrations can be drawn from agricultural mechanization.

6. The teacher educator should, with his administration, plan for staff time and budget resources to develop teaching laboratories which can be used not only to prepare the undergraduate for his role as a teacher upon receiving a Bachelor's degree and teaching certificate, but as a laboratory to demonstrate new approaches to teaching including the many innovations that are current.

It is evident there are many roles that the teacher educator can and should fulfill to help improve college educational procedures in agricultural mechanization.

Research:

Teacher educators in agriculture have a responsibility for the initiation and direction of studies in agricultural mechanics education. In the future, researchers will search for answers to new problems pertaining to agricultural mechanics program planning and evaluation, post-high school agricultural mechanics programs, agricultural mechanics programs for the disadvantaged and others. Through pilot programs, hypotheses will be tested for practical use.

It is a generally accepted fact that for effective teaching, different specialties require different tools and methods. Research on the techniques of teaching agricultural mechanics, for example, should be done through cooperative effort. The design may call for joint effort involving local schools, state and federal agencies, universities, industry, businesses and others.

Teacher education can and should play a vital role not only in initiating and directing research in agricultural mechanics education, but in helping teachers and others to put findings to practical use.

Preparation of Teaching Materials:

Teacher education programs must include provisions for the development,

updating, evaluation, adaptation, application and distribution of teaching materials and aids. Useful information may be secured from other states and agencies and in many cases little or no adaptation is needed to make the materials useful for local teachers.

Our main source of excellent technical information is the American Association for Vocational Instructional Materials. Our state curriculum laboratories have, with few exceptions, contributed very little teaching materials in agriculture let alone in a specialized content area as agricultural mechanics. Several institutions of higher learning produce publications and aids which contain both professional and technical content. Such publications and aids should result from joint efforts by the teacher educator, specialist in agricultural mechanization and others.

The demand for quality teaching materials and aids in agricultural mechanics was never greater than now. The availability of some materials has never been in closer reach of teachers, but there are gaps that must be filled in the future. In the future, more publications and aids should be developed jointly by the subject specialist, agricultural educator, industrial educator and others.

Frequently, good instructional materials and aids are available but not used or used effectively by the teacher. The teacher educator and supervisor will continue to have a significant role to play in instructing the teacher how to use what is available to him.

The preparation of teaching materials and aids is one of the growing edges of agricultural mechanics education. The need is great and many resources are available, so the challenge is to find better ways of using the resources in developing and distributing needed materials.

Professional Improvement:

Teacher educators responsible for agricultural mechanics education must stay alive in their professional and technical fields. Some of this may be accomplished through formal courses, but for most persons, the best opportunities are through individualized study of the literature, research and new developments and through attending local, state, regional and national meetings. This Regional Institute is a fine example of an inservice training program for agricultural educators in agricultural educators in agricultural mechanics. Let us hope that efforts of such magnitude will continue in years to come.

Public Relations:

This function is usually taken for granted, but much can be done to improve agricultural mechanics through public relations.

Here in this Region, we have done a fine job of exchanging papers, teaching materials and teaching aids, but we should do more, These exchanges contribute to better understanding of roles to be played by the various educators.

Through meetings in education, civic, and agricultural groups, one

can frequently find the golden opportunity to discuss objectives and problems of vocational education as they relate to specific areas, such as agricultural mechanics. Some people do not recognize the fact or understand that agricultural mechanics, for example, is career-oriented.

Teacher educators in agricultural mechanics can and should contribute news, feature and research items for local, state and national publications and professional journals. Many of you have contributed to The Agricultural Education Magazine and various agricultural journals through the years. You are to be congratulated for sharing your ideas and experiences with others.

Summary:

Teacher education in agricultural mechanics must exhibit the ability to adapt to the changing needs of the time. Programs for training agricultural mechanics teachers in most institutions must be expanded to meet the needs of the general and specialist agricultural mechanics teachers. In the future, experiences must be provided to qualify persons to teach at the elementary, secondary and post-high school levels.

Through improved and revitalized preservice and inservice training, college teaching, research, public relations, professional improvement and teaching materials, the challenge of the future will be met.

# IDENTIFYING INSTRUCTIONAL AREAS IN AGRICULTURAL MECHANICS

William C. Boykin, Sr.
Agricultural Education Department
Alcorn A & M College
Lorman, Mississippi

The fact that this Institute includes a presentation on identifying instructional areas in this facet of agriculture suggests to me that there is less than widespread agreement on the matter. It further suggests that there is a need to present a procedure for organizing the subject matter for effective instruction. The principal focus of this presentation, then, will be to offer for your consideration a structure for teaching the many and varied aspects of this area. Let us hope that this structure is both logical and psychological.

There is little doubt that there is a high level of acceptance of the major objectives of Vocational and Technical Education in Agriculture and the objectives of the Agricultural Mechanics phase of collegiate-level agriculture. These, together with the relevant subject matter, have evolved over the past 53 years. As the agricultural industry progresses, new subject matter is being infused into this area, of course.

This area of Agricultural Mechanics has been variously named from time to time and from institution to institution. There is some ambivalence relative to what the area should be called at the college level. Some of the labels used are "Agricultural Engineering," "Agricultural Mechanics," "Farm Mechanics," "Agricultural Mechanization," "Agricultural Engineering Technology," to name a few. Regardless of nomenclature, I would suspect that, when the dust clears away, we are all talking about the scientific principles, the technology and the practice activities or skills involved in the more or less mechanical aspects of the agricultural industry; the application of these principles, technologies and skills to the problems of efficient production, processing and distribution of agricultural goods and services for the use of man and animal. This is, at least, the point of reference of this paper. The position is also taken that the organization presented is intended principally for the preparation of vocational agriculture teachers and only incidentally to prepare technicians.

Vocational agriculture teachers tend to teach as they have been taught, not as they have been taught to teach. Thus, this paper focuses on

---

This paper was presented at the Summer Institute in Agricultural Mechanics Education (Southern Region) at Virginia Polytechnic Institute, Blacksburg, Virginia, August 3-7, 1970. Dr. Boykin is the former head of teacher education in agriculture at Alcorn A & M College, Lorman, Mississippi. He is now on leave from this position as Director of Institutional Research: Self-Study at Alcorn A & M.

systematic organization of subject matter into related and interdependent wholes to facilitate appreciation, understanding and application of knowledges and skills; to serve as concomitant learnings to students in professional preparation.

We believe that any serious attempt to teach the varied aspects of Agricultural Mechanics should take into account the four following related factors; called Instructional Sections in this paper:

A. General basic principles of the area: The scientific knowledges involved in their proper relation to problems encountered.

B. The materials and supplies required in the area.

C. The tools and equipment customarily used.

D. The skills or operations necessary for the application of scientific knowledge.

Each area suggested in this paper is organized in this fashion. No attempt has been made to exhaust the subject matter in the areas. Those which are mentioned are only suggestive of the types of concerns which should be taken into account. It is understood that each of these areas will be further elaborated in committee sessions during the week.

It is felt that some definitions[1] are in order to establish common grounds for interpretation of this presentation:

1. Area -- An organized body of naturally related subject matter, including basic principles and technology that are deemed to be essential in vocational education in agriculture.

2. Unit -- A subdivision of an area -- (the basic teaching module).

3. Basic Principle -- A fundamental truth on which other essential truths, laws, practices, and theories are founded.

4. Technology -- The applied aspect of science.

5. Practice Activity -- Exercises, demonstrations, and similar educational experiences designed to engage the student in the effectual learning of basic principles to the extent of understanding their application in real life situations.

---

[1] Teacher's Handbook: Vocational Agriculture, (Revised 1968) Mississippi. This syllabus was begun in 1939 and has developed over the years through the cooperation of vocational agriculture teachers, teacher educators, and supervisors in agriculture. This paper has borrowed heavily from the materials contained in this manual.

Such activities are also designed to develop in the student the skills, appreciations, attitudes, etc.

## AREA I. AGRICULTURAL CONSTRUCTION

This general area includes carpentry, concrete, concrete masonry, fencing, roads, drives, walks and cattle guards.

Instructional Section A: General principles of agricultural construction (applied physics, chemistry, mechanics and mathematics).

Unit 1. Construction Technology. The meaning and significance of: floor area; cubic footage, plumb-square-level; pitch-span-stress; trusses and stress resistance; expansion-contraction; footings; drainage; framing; joints and joining; ventilation; insulation; condensation.

This unit should also include such other structural elements as standards and minimum requirements for foundations, sills, floors and subfloors, joints studs, plate, wall headers and bracing, rafters, purlines, jambs and door and window frames, sheathing and siding, roofing, interior walls and wall covering, cabinets, trim and stairs.

Note: To an ever increasing degree farm residences and service buildings are constructed under contract. It is important that farm and rural people know the technical language of construction in order to develop or understand the specifications which are legally binding under building contracts.

Unit 2. Factors of Management Decisions. The effect of design, size and location of buildings on economy, utility and convenience: effects of environmental factors on economy and convenience; comparative economy of building materials; effects of various treatments on durability of structures; economy of home-grown materials; the effects of climate, temperature, humidity and durability of foundation on economy in the use of various materials.

Note: These elements of construction should be taught in their proper relation to the many management decisions that must be made.

Unit 3. Safety Principles. Prevention of injuries; treatment of cuts, bruises, electric injury; protection against fires; storage and proper handling and use of tools and construction materials.

Instructional Section B: Materials for Agricultural Construction

Unit 1. Lumber. Kinds, grades, strength, dimensions or sizes, units of measurement, adaptability, cost and economy; hardwoods, softwoods, special kinds and their suitability and limitations for various uses; factors involved in grades and grading of lumber; special lumber classifications; symbols used; bills of materials and computation of board feet and cost; estimating.

Unit 2. Assembled Items. Windows, window casings, doors, panels, screens and screen doors, louvers, vents, etc; adaptability, cost and economy of assembled items.

Unit 3. Building Hardware and Fasteners. Nails, screws, bolts, hinges, tacks, corrugates, dowels, screen, ventilators, door fixtures, glues, gutters and downspouts; types, sizes and adaptability to various uses.

Unit 4. Concrete Materials. Types, grades, units of measurement; cost; economy. Aggregates: types of cement; qualities, grades and kinds of sand and gravel or crushed stone; effects of water-cement ratio; effects of evaporation and control measures. Concrete form construction and bracing.

Unit 5. Concrete Masonry Materials. Blocks-concrete, slag, cinder and gravel and their adaptability to various uses. Meaning of grade-A and grade-B blocks, standard sizes, half blocks, corner blocks, special shapes, computation of number of blocks needed for a given job; special precautions in handling and storing. Mortar -- mortar-mix or lime, sand and water used in mortar; proportions; requirements for given jobs.

Unit 6. Painting Materials. Types and properties of various ingredients; adaptability to various uses; units of measurement; economy and cost, pigments, vehicles, extenders; effect of weight or quality and cost; effects of thorough mixing; units of measurement; types of paints -- exterior, interior, enamels, shellacs, varnishes, stains, lacquers and waxes.

Unit 7. Preservatives. Types and adaptability to various uses and conditions; cost and economy or creosote, "pentachlorophenol," coopertox; effects on durability and finishing quality; unit measurement and strength of mix needed; method of application.

Unit 8. Glazing Materials. Types, cost and uses of glazing materials types, strengths and finish of glass; glazier points, putty and oils and their uses; conditions affecting adhesion, drying and durability of putty.

Unit 9. Roofing Materials. Types, grades and adaptability to various uses; units of measurement, cost and economy. Sheet metal: galvanized, aluminum -- corrugated, V-crimp and other designs; significance of gages, shingles: bundles, squares, meaning of shingle weight relative to cost, durability and economy and roll roofing: weight and size of rolls -- relationship to durability and economy.

Unit 10. Siding and Insulation Materials. Lumber, asbestos, sheet metal and factors affecting use of various kinds of sidings. Types of insulation, units of measure, meaning of insulation (r) value; sheets, blankets, boards, loose, etc., and methods of installation.

Unit 11. Fencing Materials. Kinds, sizes adaptability to various uses and conditions; cost and economy of various kind of wire; meaning

of woven, barbed (2 and 4 point), smooth wire; tension bars; staples, nails, corner braces, line braces, anchors; treated post, steel post, concrete post; spacing of post; meaning of gage, rolls, rod, feet; contour and straight-line layout of fences; wire tension relative to temperature; fastening, etc. Dooryard and ornamental fences.

Instructional Section C: Tools and Equipment

Unit 1. Hand Tools. Parts, functions of parts, types, grades, quality of hand tools and their adaptability to various crosscut, back, caping. Hammers -- straight, claw, ripping. Squares -- tri-and-mites, framing. Tapes, trowels, floats, brushes, bits, etc.

Unit 2. Power Tools. Parts, functions of parts, sizes, adaptability of each to various uses and conditions; cost and economy. Saws -- table saws, portable hand saws, band saws -- working capacity and limitations; safety rules, etc. Jointers and planers -- working capacity and limitations; safety features and dangers; cost and economy. Drills -- press, portable hand, bench type, Jacobs chuck, morse-taper chuck; specifications, capacities and limitation; safety features; cost and economy.

Unit 3. Fencing Tools. Characteristics, functions, cost and economy of post-hole diggers, wire stretcher, steel post drivers, wire splicers, wire-cutting pliers, plumb bob, etc.

Note: The range and variety of construction tools are too numerous to list completely here. Reference should be made to publications listed at the end of this paper.

Instructional Section D: Skills or Operations. This section is concerned with developing the manipulative abilities necessary for the application of technical information contained in Sections A, B and C above. Here should be included actual practice activities especially selected to involve a wide range of the technical knowledges. Emphasis should be placed on performing "typical" jobs with close attention to the following elements.

1. Application of General Principles (See Section A, 1-3 above)

2. Use of materials of construction (See Section B, 1-11 above)

3. Use of tools (See Section C, 1-3 above)

4. Human elements (high quality workmanship, efficient use of time, economy, dexterity, manipulation, practice and repetition.

## AREA II: AGRICULTURAL MAINTENANCE AND REPAIR WORK

This general area includes cold metal work, tool fitting, arc welding, gas welding and forging. It is sometimes referred to as "farm shop." Establishing and arranging the farm shop may also be included in this area.

### Instructional Section A: General Principles

Unit 1. The Need and Economy of Repair Work. Extent to which the need occurs on the farm; relationship to efficient production, processing, storage and transportation, availability of commercial services.

Unit 2. Extent and Adequacy of Facilities. Location and arrangement of shop layout; floor area, wall openings, electrical and water outlets, major equipment needed, lighting, tool storage, color conditioning, etc.

Unit 3. Maintenance. Causes of breakdown of equipment; effects of rusting, corroding, lubrication of moving parts, replacing worn out or broken parts. Importance of operator's manuals; stocking and storing replacement parts.

Unit 4. Metals. Major properties and uses in maintenance and repair work; working characteristics of metals (structural steel, high carbon steels, wrought iron, cast iron, aluminum, etc.); effects of heating and cooling (expansion, contraction, distortion, annealing, hardening, tempering, oxidation, etc.).

Unit 5. Metal-working Processes. (Mechanical principles) Nature of the cutting edge -- grinding processes; sharpening and shaping metals; heating effects of grinding, honing, filing, drilling and drilling speeds; nature of threading process. Physical and chemical facts relating to welding; weldability of various metals; heat fusion by gas and arc; alloying by gas, arc and other processes; prevention of hardening, softening, rusting, etc.

Unit 6. Safety Principles. Causes and consequences of accidents in repair work; hazards in location and storage of tools and equipment; color conditioning major equipment, protective equipment; first aid measures.

### Instructional Section B: Materials for Maintenance Work. (Kinds, types, sizes, units of measure, adaptability, cost and economy).

Unit 1. Structural Steel. Strengths (PSI) of mild, high carbon, cast iron, aluminum, etc. Significance and nature of heat colors; weldability of various metals. Shapes and styles of metals; identification of metals; units of measure, cost and economy.

Unit 2. Metal-working Materials. Files -- body, teeth, cuts, handles, shapes and adaptability to various uses. Hacksaw -- blades,

tooth sizes, blade types, cost of different types and sizes, wearability, operating principles. Drill bits -- parts, types, kinds, size designation, shank styles, speed of operation, adaptability to various uses, cutting oils, etc.

Note: Only example given, complete listing is too numerous for inclusion in this section.

Unit 3. Abrasives. (Adaptability, uses, care and economy) Characteristic of grinding wheels and sharpening stones; grit and size specification; meaning of "truing up" and cleaning of stones and abrasive materials. Characteristics and uses of sand paper; steel wool; size and grade designations; units of measurement; operation principles, durability, cost economy, etc.

Unit 4. Miscellaneous Materials. (Fasteners, soldering materials, forge materials) Types, kinds, adaptability of screws, nuts, bolts, units of measurement, cost and economy of use. Meaning and use of various kinds of soldering materials -- resin-core, acid-core, bar, wire; use of cleaners, fluxes; units of measure and cost. Characteristics; cost and economy of forging materials.

Unit 5. Arc-welding Materials. Kinds and types of electrodes ("ni-rod," "abrazoweld," "carbons," "self-weld"): color codes and use of electrode; meaning of AC, DC polarity; welding positions; meaning of penetration, undercut, slagging in relation to types of electrodes. Facts relating to care and storage of welding supplies.

Unit 6. Gas Welding Supplies. Oxygen, acetylene, propane butane and other welding gases. Oxidizing and carburizing in relation to kinds of welding; lenses, glasses, tip cleaners, soapstone and like supplies. Cylinders, units of measurement of gasses, color codes, etc., safety.

Instructional Section C: Maintenance Tools and Equipment.

Unit 1. Hand Tools. Kinds, types, sizes and grades of: hacksaw frames, punches, dies and die stock, hammers, chisels, and their adaptability to various uses.

Unit 2. Power Tools and Equipment. Sizes, types and adaptability of power grinders, wire wheels, buffers, drill presses.

Unit 3. Arc-welder Equipment. AC and DC welders, types, capacities; welder pacts and accessories. Operating principles of arc welders; thickness of metal in relation to amperage setting.

Unit 4. Gas Welding Equipment. Oxyacetylene tanks, tank gages, hoses and connectors, welding tips, cutting and welding torches. Operating principles of gas welding equipment; workmanship in relation to quality of equipment.

Instructional Section D: Skills or Operations. Operations especially selected to bring into play as many as possible of the general principles, tools and equipment and material as listed.

## AREA III. ELECTRICITY AND ELECTRIC MOTORS

Instructional Section A: General Principles of Electricity and Electric Motors.

Unit 1. Nature and Characteristics of Electricity. Quantity in nature; as form of energy; principles of generation; its uses in lighting, heating and motive power. Characteristics of an electric current; voltage, amperage, resistance, current value, phase, types of current.

Unit 2. Electrical Transmission. Production or generation and devices; types of generators, batteries; magnetism; relationship to induction of alternating current. Carrying capacity of wire and other conductors; insulators and insulation; voltage drop and power loss; heating effects of low-voltage. Relationship between wire size and adequacy of electrical service; length of run and adequacy of electrical service; wire-size tables -- contents and interpretation. Terminology: Watts and wattage, kilowatts, and kilowatt-hours, kilowatthour meters, horsepower; types of electric motors, circuit breakers.

Unit 3. Electrical Installation. Codes: national and local, others; inspection, testing agencies (VL and others); significance of code and test recommendations. Significance of: "polarizing." Wiring requirements: "power-drop" requirements, service entrance requirements, meter loop, service entrance cable, meter, main breaker, grounds and grounding connections, service switch; circuit requirements: types and number of outlets.

Instructional Section B: Materials for Electric Systems and Motors.

Unit 1. Electrical Wire and Materials. Exterior and interior wire, bare-copper ground wire; Romex, flexible cable; thin-wall conduit; plastic cable; armored cable; heavy duty rubber-covered cable; kitchen cord; TV; lamp. Wire sizes: meaning of No. 12, two-wire cable, service-entrance cable, current-carrying capacity. Kinds of switch and outlet boxes and adaptations; plugs, fuses, connectors, tapes (plastic, rubber, friction). Electrimotor: lubricating oils, special greases, time delay fuses, V-belts and cords; speeds and speed regulation of driven machines and devices.

Unit 2. Lamp and Lighting Fixtures. Floor lamps, table lamps, ceiling fixtures, fluorescent fixtures, "par-30," and other lighting devices; yard lights; economy, quality and convenience of lighting fixtures. Inside frosted bulbs; 3-way bulbs; fluorescent tubes and circlimes; sizes, cost of bulbs and tubes.

Instructional Section C: Tools and Equipment for Electrical Work.

Unit 1. Hand Tools. Slip joint pliers; keyhole saws; electrician's pliers; "fish tape" wire; cable stripper; folding rule; screw driver; brace and electrician bits; soldering equipment.

Instructional Section D: Skills and Operations.

## AREA IV: AGRICULTURAL MACHINERY

Instructional Section A: General Principles

Unit 1. Principles of Design and Utility. Physical and mechanical laws relating to design of farm machinery; power requirements of various machinery; relationship between agricultural machinery and processing, production, transportation and economy in production; major cause of deterrioration.

Unit 2. Soil Preparation Machinery. Characteristic, design, function and cost of plows, disk harrows, mulchers, subsoilers, etc. Their relation to pulverization, moisture-holding capacity, seed germination, and tilth.

Unit 3. Cultivation Machinery. Characteristics, design, function and cost of various types of cultivating equipment. Their use and relationship to efficient production.

Unit 4. Planting and Fertilizing Machinery. Characteristic of design, functions, cost of planters, distributors, sprayers, dusters and their relationship to economy and production.

Unit 5. Harvesting Machinery. Characteristics of design, function and cost of mowers, hay conditioners, rakes, combines, silage harvesters, cotton pickers, corn pickers, etc., and their place in modern agriculture.

Unit 6. Miscellaneous Machinery. Characteristics of design of special equipment such as feed grinders and mixers, crop driers, milk coolers, feeders, egg-handling equipment, milking machines, land levelers, irrigation equipment.

Unit 7. Safety and Maintenance Principles. Extent and prevention of accidents in the use of machinery; hazards according to specific machines. Interpretation and use of operator's manual, periodic maintenance "checkups," etc.

Instruction Section B: Materials and Parts for Maintenance and Repairs.

Unit 1. Lubricants and Repair Kits. General and special purpose greases; engine oils; cleaners. Specific machines; availability of repair kits for machine components.

Unit 2. General Hardware and Costs. Ordering and stocking frequently-used nuts, bolts, screens, pins, belts, pulleys; comparative cost of repairs on machinery; relationship to cost of preventive maintenance.

Instructional Section C: Tools for Agricultural Machinery

Unit 1. Hand Tools. Characteristics and use of special and general purpose wrenches; grease guns, oil dispensers, tire tools, hammers, etc., needed to maintain agricultural machinery.

Unit 2. Power Tools. Characteristics and use of air compressor and regulator, air pressure gage, paint spraying equipment, portable grinder; grease dispenser, jacks and hoist, etc.

Instructional Section D: Skills or Operations

## AREA V: TRACTORS, AUXILIARY ENGINES, TRUCKS

Instructional Section A: General Principles

Unit 1. The Economics of Farm Power. Power-cost relationships. Tract[illegible] size, type and number and the economics of ownership. Meaning of power and horsepower; factors of mobility and adaptability for various uses. Mechanical advantage of power units; importance of periodic maintenance; the operator's manual.

Unit 2. The Internal Combustion Engine. Characteristics and functions, 2-stroke and 4-stroke cycle, valves and valve timing, ignition, pistons and rings, cylinders, spark plugs, shafts; combustion, compression, firing orders, power transmission.

Unit 3. Farm Tractors. Types of farm tractors and their adaptability to various uses. Tractor systems: Fuel -- carburetor, air filters, fuel filters, tanks, cutoffs, gages, regulators, lines, pumps, governors, connector, etc. Cooling -- thermostats, water pumps, coolants, fan, radiator, hoses, clamps, drains, etc. Lubrication -- crankcase, chassis, wheel bearings, transmission, power lifts, pressure and splash types, etc. Electrical -- battery, generator, starter, magneta, distributor-timer, wiring, regulators, coils, lights, switches, fuses. Power train -- clutch and connections, drive shaft, universal joints, differential and axles, wheels, PTO, pulleys. Steering -- manual and power. Hydraulic -- pump, cylinders, hoses, valves, connectors. Controls.

Unit 4. Safety Principles. Extent of tractor-related accidents; accidents in relation to slope of land, obstructions, height of hitch, load and highway.

Instructional Section B: Materials and Supply Parts

Unit 1. Fuels. Gasoline (octane ratings); diesel fuels (no. 1 and no. 2); LP gas, "octane" and "cetane" ratings in relation to performance and cost; units of measurement.

Unit 2. Greases and Oils. Crankcase; gear oil; lubricating greases. Meaning of viscosity, hypaid, hydraulic and multi-purpose greases, SAE 30, 10-20, MS; additives; units of measurement.

Unit 3. Spark Plugs and Points. Types and adaptability to various uses; cost and economy; function of spark plugs, points, condensers, hitch pins and other common devices.

Instructional Section C: Tools & Equipment

Mechanic's general purpose wrenches (open-end, box, socket, adjustable; special -- iginition, torque, allen-head, valve; maintenance equipment -- battery hydrometer, cell tester, compression tester, feeler gages, spark plug tester, stud extractor, gear pullers, timing light, jack, chain hoist, creeper.

Instructional Section D: Skills or Operations

Operations especially selected to apply general principles, tools and equipment, and materials above in the development of performance skills.

## AREA VI: WATER SUPPLY AND DISPOSAL SYSTEMS

Instructional Section A: General Principles

Unit 1. Water Supply and Sanitation. The need for water in production and home consumption; peak periods; supply in relation size and type of system, economy, convenience and sanitation. Water conditioners -- types, characteristics and functions; softeners and purifiers, mechanics and principles.

Unit 2. Climatic and Physical Factors of Water Supply. Temperature ranges in the locality; effects of freeze-ups on layout; climate and use of cisterns and ponds. Friction in water pipes; size of pipe and flow of water (gpm and gph); relation of gpm to size of pipe, length of run, pressure and elevation. Meaning and significance of "pumping," well depth, "water horsepower" -- computation procedures.

Unit 3. Maintenance Principles. Importance of operator's manual; lubricants and lubrication, adjustments and periodic maintenance, "check-ups"; effects of inadequate electrical service on pump motor; meaning of "water logging" -- correction.

Unit 4. Sewage Disposal Systems. Septic tank, filtration field -- requirements; lagoons; relation of system layout to soil type and topography.

Unit 5. Pumps for Water Supply. Types of pumps -- shallow-well (centrifugal, piston, jet, submersible) -- mechanics of operation. Sizes of pumps -- rating in gpm and gph; horsepower requirements ("suction head," "pressure head," friction losses). Type of pump motor -- effects of depth of well, starting pressure, sanding conditions, etc; discharge and supply pipe sizes.

Instructional Section B. Materials for Water Supply and Disposal Systems

Unit 1. Pipes and Fittings for Water Supply. Types and uses -- galvanized, wrought iron, copper, plastic, etc. Units of measurement -- length, diameter, special measurements. Fittings -- tees, ells, valves, unions, sleeves, cost per unit and uses; cutting liquids, fitting compounds and uses of each; pump repair kits.

Unit 2. Materials for Water Disposal Systems. Sinks, lavatories, tubs, showers, commodes, drains, traps, septic tanks; kinds of sewerage pipes, branches (T, Y, offsets, etc.), uses of each, cost, economy, etc. Oakum, lead cement, caulking compound, asphalt, etc.

Unit 1. Pipe-fitting Tools. Pipe cutters, reamer; threader, wrenches, steel type, pump-maintenance repair kit, folding rule, characteristics, cost and use of each.

Unit 2. Plumbing-Disposal Tools. Fire pot, ladle, melting pot, caulking iron, yarning hammer, level, etc.

Instructional Section D: Skills and Operations

# TRENDS IN VOCATIONAL AGRICULTURE

# AND AGRICULTURAL MECHANICS EDUCATION

H. N. Hunsicker
Agricultural Education Service
U. S. Office of Education
Dept. of Health, Education, & Welfare
Washington, D. C.

Agricultural engineering as a profession has made dramatic strides in the past 30 years and deserves much credit for the mechanical advances in the industry of agriculture today. You are acquainted with the wide range of technical advancements which, in a short period of time, have created an evolution of farm power and machines. From horses, steam threshers and walking cultivators have evolved today's big tractors, combines and complex agricultural machinery. What is not often recognized is the importance of education in bringing about this mechanical revolution.

Agricultural engineers project that as many exciting developments in mechanization are ahead in the next 30 years as have taken place in the past 30 years. But, whatever technological advances lie ahead, one thing is certain, education will be required to narrow the lag between research and development and practical application. No machine is better than man's understanding of it and his skill and ability to use it. Adequate training, therefore, is essential if the machinery is to serve the owner efficiently and make a profit for the manufacturer as well. Obviously everyone gains by education and training in agricultural mechanization. For this reason both of our professional groups have been and will continue to be closely allied.

Paralleling the dramatic strides in agricultural engineering are equally exciting changes in vocational agricultural education. Often these changes are not as obvious but they are just as dramatic, reflecting the growth and development of the agriculture industry.

Prior to 1963, vocational agriculture by law was designed chiefly to prepare youth and adults to farm. Actually, however, when one analyzed the needs of farmers and the variety of subjects taught in agriculture, the program served well as an introduction to many different careers in agriculture. Classroom subjects including agricultural chemicals, insecticides, animal nutrition, genetics, recordkeeping, finance, farm mechanics and conservation have stimulated hundreds of youth to specialize in these agricultural related fields.

The Vocational Agriculture Acts of 1963 and 1968 broadened the scope of vocational education in agriculture to include "training for agricultural occupations both on and off the farm." It also stressed greater concern for persons of all ages - both youth and adults - in all types of communities, including rural and urban. It required that teachers work

with the disadvantaged and the handicapped and provided for programs in secondary school, post-secondary institutions, residential schools and private schools. Finally the new Vo-Ag Acts stressed the value of co-operative work experience, research, teacher education and other ancillary services.

The term vocational agriculture gradually is giving way to "vocational agri-business education." The new look in the vo-ag program identifies seven clusters of occupations including farming, agriculture supplies/services, agricultural mechanics, agriculture production/processing, ornamental horticulture, agricultural resources and forestry. Generally most agriculture occupations can be classified under one of these areas. The areas, however, are subject to modification as the need arises.

Agriculture engineers will continue to be the professional group providing agri-mechanics instruction for teachers of agriculture. For this reason, it is important that we be aware that teachers trained in the 70's will be teaching students who will own, manage and operate machinery in the year 2,000 and beyond. Obviously, the agri-mechanics instruction today must be relevant to farming and agri-business needs of the future. Most agriculture engineers, manufacturers and leaders in agri-business have some knowledge of the machinery projected to the year 2,000. Encourage all of these individuals to join agriculture educators in developing curriculums and courses of study to prepare teachers and students for the years ahead.

Keep in mind that the school situations and organizational patterns in vocational agriculture may differ widely from state to state and even from school to school. These variations have a marked influence on the instruction in agri-mechanics. The following are some organizational patterns we must consider in developing courses of instruction:

1. The most common organization of courses in vocational agriculture is:

   (a) Exploratory in grades 9 and 10, including basic skills in agri-mechanics.

   (b) Specialization beginning in grades 11 and 12 - students select career objectives.

   (c) Specialized occupational training for employment in grades 13 and 14 (post-secondary).

2. Specialized agri-mechanics courses offered in many high schools.

3. Multiple teacher agriculture departments are increasing (32% in 1969). Usually one teacher is a specialist in agri-mechanics.

4. School administrators are demanding:

   (a) Instructors be well trained and knowledgeable in agri-mechanics.

   (b) Continuous in-service training for instructors.

   (c) Instruction related to employment.

5. Students with different career objectives may be in the same agri-mechanics class.

6. Greater emphasis on occupational experience.

7. More classes in agri-mechanics for young farmers and adult farmers.

The projected changes in agriculture mechanization in the years ahead will necessitate that professional agricultural educators at the universities work closely with agricultural engineers in determining appropriate courses for prospective teachers. Recently I asked manufacturers of farm machinery, agricultural engineers and professors in agriculture education as well as machinery users what training they felt teachers of agri-mechanics would need in the future. Their recommendations included the following:

1. Ability to motivate students to use machinery efficiently.

2. Effective use of FFA awards program in agri-mechanics.

3. Kinds and amounts of instructional equipment and supplies needed for school shops.

4. How to make machinery pay as well as how to operate it <u>efficiently</u> and <u>safely</u>.

5. How to select machinery for specific purposes.

6. Understanding of the principals of mechanics including:

   (a) Hydraulic systems.
   (b) Electrical systems.
   (c) Control systems.
   (d) Fuel systems.
   (e) Water systems.

7. How to protect and store machinery.

8. Understanding of the economics, management and control of mechanical power, especially farm power.

9. Understanding of career opportunities in agri-mechanics.

10. Understanding of the techniques of cooperative work experience in all types of agricultural establishments.

11. Understanding of <u>labor laws</u> and <u>IRS allowances</u>.

12. How to make field tests.

13. How to establish shops on farms.

14. Ability to thoroughly inspect machinery and to identify worn parts and repairs needed.

15. Familiar with sequential damage resulting from lack of needed repairs.

16. How to repair small gasoline engines at the high school level and larger ones at the post high school level.

17. How to service machinery.

18. Knowledge and use of electricity.

19. Knowledge of plumbing.

20. An understanding of farm structures.

21. Understand the values of training in agri-mechanics.

22. A knowledge of agri-mechanics publications and references.

23. Knowledge of anti-pollution practices.

24. Learn dealer relationships.

There is no doubt that vocational agri-business teachers in the future will be more and more involved with mechanics. [redacted] will be specialists in this field, but all teachers will need training to keep abreast of the needs of their particular occupational area. The day is past when six to nine hours of specialized course offerings will be adequate preparation for teachers of agriculture mechanics. The future, however, is promising for those who will prepare for it with a complete training program in the areas I've mentioned.

ENROLLMENT TRENDS IN AGRICULTURAL EDUCATION

BY YEARS AND LEVEL OF INSTRUCTION

1960 - 1969

| LEVEL OF INSTRUCTION | 1960 | 1965 | 1967 | 1968 | 1969 |
|---|---|---|---|---|---|
| Secondary (H. S.) | 462,756 | 517,700 | 509,000 | 528,000 | 536,039 |
| Post Secondary (Voc.-Tech) | - | 2,000 | 8,000 | 11,000 | 15,816 |
| Adult | 342,566 | 367,000 | 413,000 | 305,000 | 290,336 |
| Special Needs | - | 1,300 | 17,000* | 20,000* | 35,729* |
| TOTALS | 805,322 | 888,000 | 935,000 | 851,000 | 850,705 |

* 12,000 of the Special Needs Enrollment was included in the Secondary Enrollment in 1967, 13,000 in 1968, and 27,215 in 1969.

- Defining Affective Goals
- Evaluating the Usefulness of Objectives
- Analyzing Performance Problems

presented by

Robert F. Mager
Mager Associates

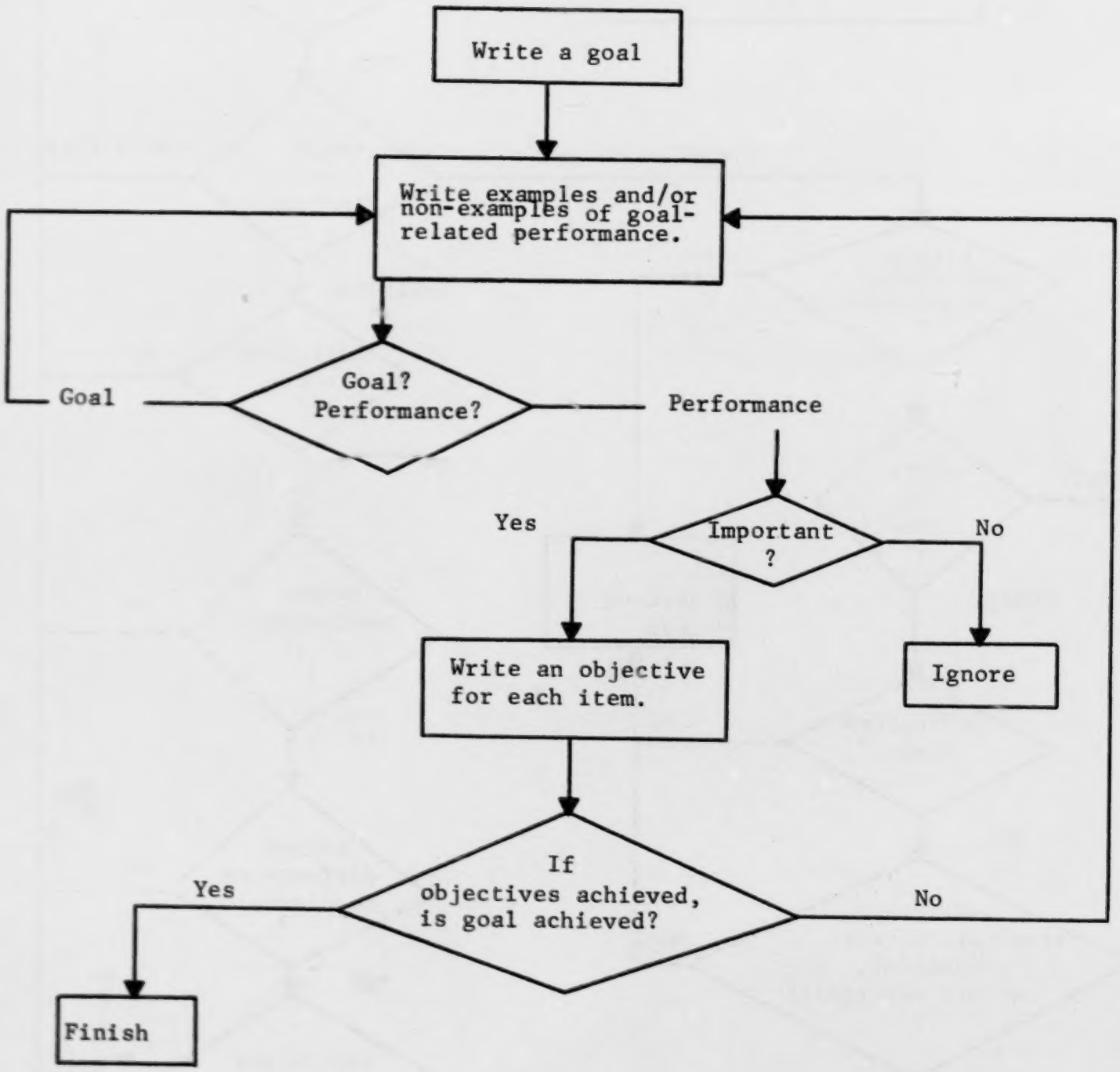
Summer Institute in Agricultural Mechanics
in Education

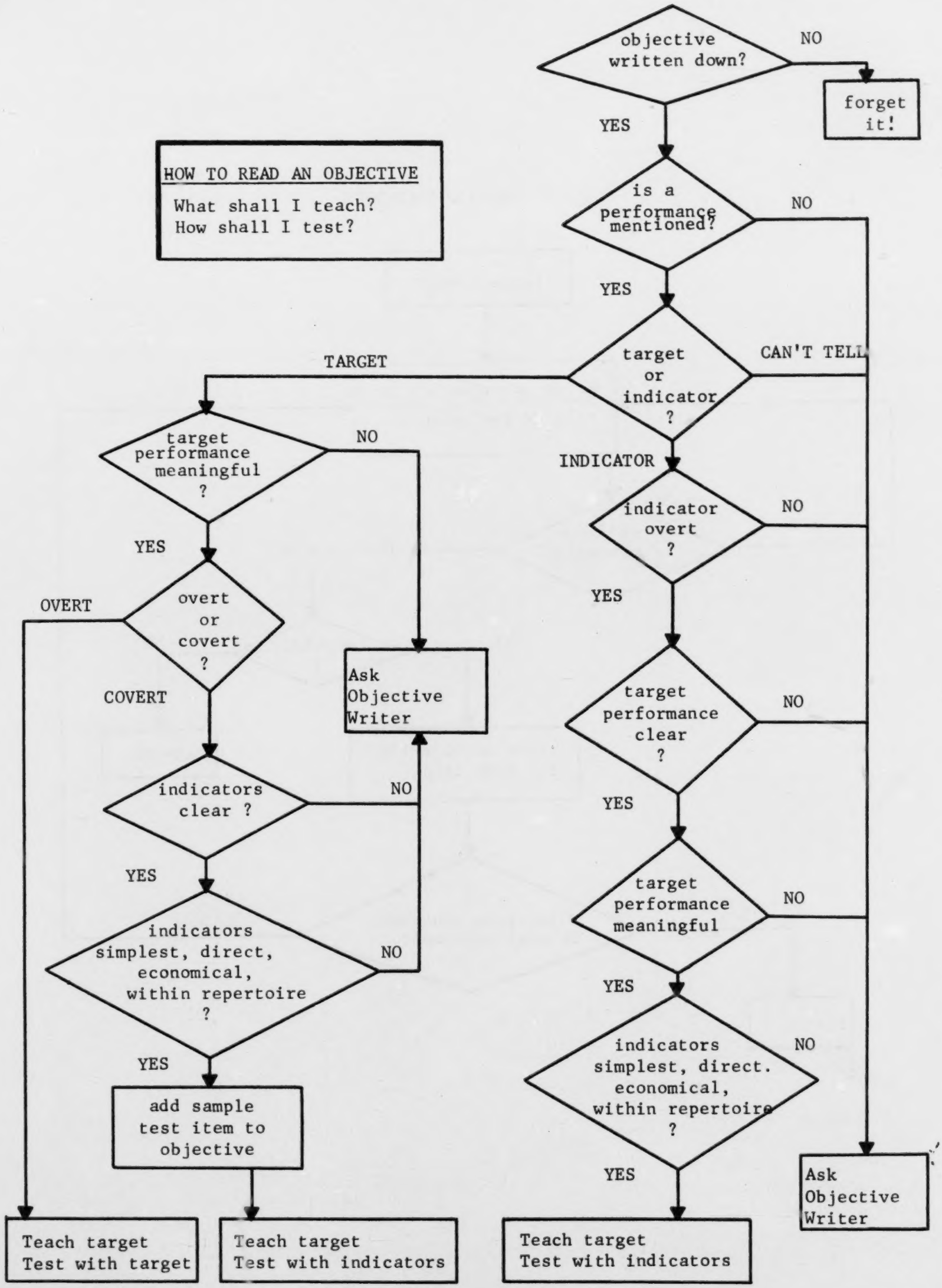
Blacksburg, Virginia
August 5, 1970



67

GOAL DEFINITION FLOWCHART




HOW TO READ AN OBJECTIVE
What shall I teach?
How shall I test?
objective written down?
NO
forget it!
YES
is a performance mentioned?
NO
YES
target or indicator ?
CAN'T TELL
TARGET
INDICATOR
target performance meaningful ?
NO
YES
overt or covert ?
OVERT
COVERT
Ask Objective Writer
indicators clear ?
NO
YES
indicators simplest, direct, economical, within repertoire ?
NO
YES
add sample test item to objective
Teach target Test with target
Teach target Test with indicators
indicator overt ?
NO
YES
target performance clear ?
NO
YES
target performance meaningful
NO
YES
indicators simplest, direct. economical, within repertoire ?
NO
YES
Ask Objective Writer
Teach target Test with indicators

WORKSHEET

Target Performance - Indicator Behavior

1. Given a series of pictures, color all the animals.

2. Be able to multiply any two-digit numbers.

3. Demonstrate that the way you group whole numbers in an addition problem makes no difference in the answer.

4. Be able to write the symbols for at least twenty electronic components.

5. With a multimeter measure the voltage at ten given test points, to within three percent accuracy.

6. Be able to ride a bicycle at least one hundred yards without falling off.

7. Be able to form new words by changing the initial consonant.

8. Demonstrate an understanding of the difference between an epic and a sonnet by writing one of each.

9. Juggling three balls, toss and catch at least seven consecutive balls without dropping them.

10. Be able to construct a graph to represent a given set of data.

11. Given the script for a TV commercial and a clock with a second hand, be able to read the commercial at any rate between 80 and 180 words per minute.

## TRAINING . . . OR MANAGEMENT?

I. <u>I think I've got a training problem</u>.

| | |
|---|---|
| 1. What is the discrepancy? | How does the performance we have differ from the performance we want? |
| 2. Is this discrepancy important? | Realistically, what would be the consequence if we ignored it? Should we simply change our standards? |
| 3. Is the discrepancy due to a skill deficiency? | Right now, if his life depended upon it, could he do it correctly? |

II. <u>Yes, it is a skill deficiency</u>.

| | |
|---|---|
| 4. Was there a time when he could do it? | Through lack of practice or for some other reason, has he lost a skill or facility he once had?<br><br>Is he hesitant to use the skill because he has lost confidence? |
| 5. Is there an easier or cheaper way than formal training? | Can we use job aids -- labels, signs, colors, checklists?<br><br>Can we show him rather than train him?<br><br>Can we use on-the-job training?<br><br>Can we hire rather than train? |
| 6. Does he have the potential to perform? | Could he learn it?<br><br>Does he have what it takes, mentally and physically, to do the job? (Is he either under - or over-qualified?) |



671

III. <u>No, it is not a skill deficiency</u>.

| | |
|---|---|
| 7. Can we change the means of production? | Can we move or change the tools, machines, materials, or work-space he uses? |
| 8. Can we change the conditions of production? | Can we reduce interference by improving lighting, changing colors, increasing comfort, modifying the work position, reducing visual distractions or noise, changing restrictive policies, or ensuring that no conflicting demands are made?<br><br>Can we reduce "competition from the job" -- phone calls, "brush fires," demands of less important but more immediate problems? |
| 9. Can we change the operation he performs? | Can we simplify or change procedures? Can we change the order of implementation? |
| 10. Is he getting feedback about his performance? | Does he know his performance is not satisfactory? |
| 11. Is there a meaningful consequence for performance? | Is there a pay-off for desired performance?<br><br>Does desired performance matter?<br><br>Does he get satisfaction of needs from the job? (Does he have a chance to meet interim goals?)<br><br>Is he able to take pride in his performance as an individual or as part of a group? |

| | |
|---|---|
| 12. Is performance punishing? | Would performance reduce his status? (Does he get pressure from collegues, the union, or elsewhere if he does more than he does now?)<br><br>Does he perceive higher performance as geared to penalties (as in "higher taxes for higher income from piecework")? |
| 13. Is he, in fact, rewarded for not performing? | Does his current performance lead to status? (Does it make him feel important when he's a bottleneck, when he has power over others as in making them wait?)<br><br>Is he physically inadequate so that he gets less tired if he does less?<br><br>Is he "mentally inadequate" so that the less he does the less he has to worry about?<br><br>Is he being rewarded for his current performance? (Does his boss have a "double standard" of theory and practice? Or is that his perception of his boss's views?) |
| 14. Is your proposed solution worth its costs? | Is the cost of training/managing less than the cost of not training/managing? |

# APPROPRIATE TERMINOLOGY FOR AGRICULTURAL MECHANICS EDUCATION

Dr. Carlton E. Johnson
Agricultural Engineering Department
Ohio State University
Columbus, Ohio

"What's in a name? That which we call a rose by any other name would smell as sweet" so says Shakespeare in Romeo & Juliet (Act II Scene 2, Line 43.) Gertrude Stein said, "Rose is a rose is a rose," (Sacred Emity,) The Autobiography of Alice B. Toklas. Title of a book, 1933.

A further insight into terminology may be found in Alice in Wonderland. "But Glory doesn't mean a nice knock down argument," Alice objected.

> "When I use a word," Humpty Dumpty said, in a rather scornful tone, "it means just what I choose it to mean - neither more nor less."
>
> "The question is," said Alice, "whether you can make words mean so many different things."
>
> "The question is," said Humpty Dumpty, "Which is to be master - that's all."

To quote a less well known authority when I was teaching vocational agriculture down in the hills of Kentucky, "Bloody Breathitt" County, I can recall a high school boy who said, "I want a drink of warter, rat now." My friends North of the Ohio River might not understand these terms but when he spelled water it was w-a-r-t-e-r, but "rat" was spelled r-i-g-h-t. There was no doubt about what he wanted or when.

Terminology has always "bugged" us as we try to communicate. The importance of the proper image is always being stressed. The term "Public Relations" developed a bad connotation due to the advance publicity man in the "good old days" who preceeded the coming to town of the circus by making rash promises which were never kept because he knew he would be gone before anyone could catch him. Today we use the title "Public Information" instead of "Public Relations."

Another word often in bad repute is "propaganda," depending on whether you personally are for or against whatever is being proposed.

Fundamentally, however, we are forced to recognize that in any case

---

This paper was presented at the Summer Institute in Agricultural Mechanics Education, Southern Region, at Virginia Polytechnic Institute, Blacksburg, Virginia, August 3-7, 1970

our problems in appropriate terminology for agricultural mechanics are problems in semantics. Semantics comes from the Greek word semantikos literally "significant meaning" and more broadly "the science of meanings." Semantics is a fascinating study because words have so many different meanings to each of us. First we must recognize that a word is only a symbol for the real thing and the real thing has meaning to us personally only to the extent we have experience with the "real thing" or to the extent we can vicariously make ourself experience the word symbol. Certainly we would have to cut off an arm to truly become aware of what it is like to miss one. Many of you have probably had an arm in a sling at one time or another and thus have at least some understanding and empathy for a person with a missing appendage. Nevertheless it is not the same as having a missing arm or finger or eye or whatever. Perhaps a more difficult empathy confronts the male when some female says "you have to have a baby to know what it is like" or better yet, consider the dilemma of the unmarried instructor being initiated into a vocational education club who has said he believes in vocational education, when the next question is "How would you teach sex education vocationally?"

In trying to communicate the language of our profession to those not in our profession of agricultural mechanics education, whatever that may be, I am sure the many persons whom we wish to inform and to have empathy with our various aspects of the profession figuratively have many missing fingers, arms, eyes, etc. Thus, we constantly strive to interest them in our activities but all too often we are only talking to ourselves.

Nationally I chair the "Committee on Instruction in Agricultural Mechanization, A-214," of the American Society of Agricultural Engineers. This Committee was formerly called "The Committee on Vocational Agriculture Teacher Education." The change in name tends to reflect a change in function to a broader interest in all aspects of agricultural engineering not directly associated with the professional agricultural engineering degree. Thus we have been launched on many underfined areas of knowledge. Perhaps many of you have reviewed our most recent effort in trying to delineate our responsibilities. It is called "Report IV, Agricultural Engineering Phases of Teacher Education in Agriculture."[1] How many of you have a copy of this report in your files? It was sent to all departments of Agricultural Engineering, also to Agricultural Education Departments, both teacher education and supervisory staffs and hopefully was distributed to every teacher of vocational agriculture in the United States. Did teachers in your state get a copy? If so, how did they use it? Were they familiar with the five technical subject matter areas as outlined in the report:

1. Farm Power and Machinery.
2. Structures and Environment (formerly Farm Buildings and Conveniences) now broadened to include confined housing and more on grain drying.
3. Soil and Water Management.
4. Electric Power and Processing (formerly Rural Electrification)

also broadened to include more on processing both grain and fruit and other food materials.

5. Agricultural Construction and Maintenance (formerly Farm Shop), also broadened to more nearly represent what we teach.

Today there is a sixth area "Food Engineering." How do we fit into this phase?

The applied phases of these technical subject matter areas to most of us have generally been referred to as "Farm Mechanics."

"Farm Mechanics" has been defined by Farrall[2] and Albrecht in the book Agricultural Engineering - A Dictionary and Handbook as the unspecialized, mechanical activities performed on the farm and in the home. Areas of activity are farm power and machinery, electrification, farm buildings and conveniences, rural electrification, preparing farm products for storage or use, and soil and water management.

In the Dictionary of Education[3](p. 339), I found a less descriptive and somewhat obsolete definition as follows: farm mechanics, a phase of vocational education in agriculture which includes the study of farm shop work, farm machinery, soil and water conservation, farm structures, and farm electrification.

Today we use the term "Agricultural Mechanics" which has the broadened meaning to include specialized agriculturally related activities permitted by the Vocational Act of 1963, such as Horticultural Mechanics, Recreation, Conservation and Forestry Mechanics, and Mechanics for the Agricultural Engineering service occupations.

We are currently writing "Report A Agricultural Engineering Phases of Technical Education in Agriculture." Beginning in 1964 at various agricultural engineering meetings we have had numerous papers trying to define and communicate with ASAE members the meaning of the term technician and technologist. I would like to take a few minutes to discuss this phase with you as a means of illustrating the complexity of defining terms. I would also like to show the relationship of technical education to total education by reviewing the status of the working population in Ohio and relating this to the educational programs in our schools.

> In July, 1964, speaking to the National Seminar on Agricultural Education, "Preparing Agricultural Technicians" Shoemaker[4], Director of Vocational Education in Ohio reports some interesting data on Ohio population which probably represents a similar current educational level for the population of most of the United States. Shoemaker said . . . . "in terms of trying to identify the levels of people and numbers of people in agricultural education. We had a chart (Figure 1) which we have been using for years in which we pointed out some of these occupational levels and needs in Ohio from the census figures of 1960. We found, for instance, that 42.2 percent of our

people, according to our census, are employed as craftsmen, technicians, operatives, or semi-skilled workers in industry. We found that 7.6 percent of our people were in occupations requiring a baccalaureate degree. We have some other people with baccalaureate degrees in these other areas. Now our first chart on employment showed that 3.7 percent of our people were employed in farm production agriculture occupations, and according to our census, that's all they show . . . . Now you can quarrel with that and argue with it, but the point is, this is the figure used by our people in government.

(Herbert Brum[5] conducted a very sophisticated study) in which he found . . . that although 81 percent were taking college preparatory courses at least 80 percent of the jobs did not require a college degree.

One of the new areas for expansion in all vocational fields, whether it's agriculture, business, or whatever, is in the area of post-high school education at both the skilled and the technical levels. Now I am going to use the term "skill" when I speak of what you normally class as your agriculture programs -- as a skill level of program as contrasted with technical education.

. . . . Everybody can be called a technician. The person that comes into your home and changes one TV tube after another until he finally hits the right tube is called a technician. The brake specialist who does nothing but work on your brakes calls himself a technician. Everyone calls himself a technician today. It's a popular term.

Some of the vocational programs at the high school level are called technical because the idea of technical is popular. People want to call everything technical and you can become quite confused. It took me two or three years, several years back, to try to figure this thing out before we finally identified our purpose and just what should be called technical. As we began to talk about technical education to the people in agriculture they said, "Wonderful!" In the post-high school program we will train some fine mechanics. The thought was expressed, "I do need a helper on the farm and if you will train a person two years beyond high school, I know he will make a better helper on the farm." Well, gentlemen, this is fine, but it is not technical education. It is important to do, and when I speak about technical education I am not downgrading in any way the

need for continuing the other areas of horticulture and agricultural training. Too often, as we begin to talk about technical education, we think we have to step on everything else that's been done before in order to build technical education. This is not true. We are talking about another area -- a new possibility in the area of education.

Technical education in agriculture is new. It's so new that educators are going to lead the industry. Industry isn't hollering for technicians in agriculture right now for the very simple reason that they don't know what a technician is. They don't know what they can do.

I was in Indiana where they had some exhibitors. I was talking to a man who was handling chemicals for agriculture and as we talked we began to find out that that area of work needs some technicians. They have been using engineers for a certain spot. He said, "We don't need engineers, but we don't have anything else to put in that occupation."

It's pretty important to understand the level and place of technical education, so I want to talk about the levels as we look at the spectrum of employment in industry.

At one level to the right on Figure 5 you have a small group of people, even smaller than shown here -- a group of people called "scientists." These are trained in your graduate programs in the universities. You very seldom, if ever, find a scientist that came up the hard route. It's hard enough going the way he has to go through the university level. But this is a small group of people.

Engineers support the scientists. These are the people who take the ideas, the raw ideas, from the scientists and develop them into something that you and I can use. You have known about engineers for years -- mechanical, civil, electrical, aeronautical, chemical -- all the engineering fields, and in your own area, your agricultural engineers. This is a professional level. Whatever your professional levels are, they would fit in here, trained at the baccalaureate level in the university. They have been pushing the engineer more and more into the theoretical level. They've required more knowledge in the engineering levels. It used to be that when I graduated from college, to become an engineer a person had to spend five years "on the board" as they called it -- five years drafting in order to become an engineer. Today, the engineering school doesn't even

have time to give them the skills of drafting. In civil engineering, they had to drop surveying because they don't have time, with all the other things they teach, to put this in engineering.

So a new place has been developed in the field, not substituting for the professional, not substituting for the skilled, but a whole new area of education related to engineering, a group of people which we are calling technicians. This is the group of people of whom we are speaking as we use the term "technician" in Ohio.

Supporting this group of people are the skilled craftsmen, machinists, tool and die makers, welders, sheet metal workers, cosmetologists -- what we class as the skillcrafts level in the industrial area. A supporting group for them are the semi-skilled workers, the individual machine operator whom we class as semi-skilled. Then the fading group at the other end are the unskilled.

The only reason for identifying these people separately is that you organize an educational program differently to serve each group of people and that's the only reason -- not for status purposes, but because you're going to organize their educational program differently.

If we look at the area on the chart below the curved line as being the amount of technical knowledge required by these different occupational groups and the area above as the amount of manipulative effort and skill required, we will get some concept as to why the programs are different for these groups.

As we delve into the craftsman level here, there are even different levels of technical knowledge needed. At one end might be the bricklayer who has great need for mechanical skills but less need for technical knowledge. At this end of the occupational area there might be an electrician, most of whose work is in what he knows. This group of skilled people are concerned with construction, maintenance, repair, and servicing.

As we move to the technical group, we are talking about design, development, testing, and management. This is the easiest way I know to explain it to a group of industrialists. For this group, then, their stock in trade becomes their technical knowledge. They don't need to be able "to do" as much as they need to be able "to know" about doing and be skilled in the work related to the professional area. You draw the correct curriculum content and organization of the program from the professional field, providing sufficient

skills for this field to enable them to understand about the area. Science and engineering, of course, move on higher and higher in the realm of the theoretical and the technical ladder.

Let me give you a team relationship. Here might be a mechanical engineer, a tool and die designer and a tool and die maker. All three are part of a team relationship -- no one serving the job of the other one or taking over the job of the other person.

In Ohio, we set up these standards as we began to develop post-high school technical education, and incidentally, we believe that technical education is post-high school education. We believe that vocational or skilled level education can be done at the high school level but we believe true technical education is post-high school education. We have set these standards for ourselves in Ohio. . .

Shoemaker[4] discussed curriculum for technical education as follows:

We say that the curriculum should be such that it is not controlled by a desire of those who are going on to a four-year college program. My feeling (I'm expressing opinion here now, not fact) is that if you organize your curriculum so as to provide college level credit, you will not end up with a technical program at the level which will best serve the persons and industry and the business. It must have a level of its own; it must have a curriculum of its own; it must have a status or position of its own, if it is going to grow and serve rather than gradually evolve into the first two years of a college engineering program. You don't need technical education for that. The colleges have very fine first two-year programs leading into engineering fields. Such a procedure would provide a "me, too" operation. You will find in some places that the two-year institutions, some very fine institutions, apparently have become simply ashamed of what they were doing and are trying to grow into four-year educational engineering institutions.

. . . . The people from the field, the leaders from the field of agriculture, sat with our staff and determined that one of the areas that was needed was an agricultural equipment technician, not a repairman. This man will not repair equipment. Repairing equipment is good and needed but it is not a technician level program. This will be a type of curriculum that will be used, as we see it now, for the students entering a two-year, post-high school program in agricultural equipment technology.

> . . . . Wherever the profession will accept a para-professional (and I have begun to use this word simply because I don't like the word "semi" under which we seem to be putting a status situation in terms of the individual), a person who works alongside a professional.

Thus after a long description you begin to get the idea of what a technician is and what he does.

In the Dictionary of Education[3] I found the following definitions which are much shorter but without the benefit of the previous discussion would be somewhat hazy for one not already informed of the nature of technical education:

> p 554 technician: a worker on a level between the skilled trade worker and the professional engineer; his technical knowledge permits him to perform many of the duties formerly assigned to the graduate engineers; he may design the mechanism, compute the cost, write the specifications, organize the production, and test the finish of the product.
>
> p 555 technological education: that education which emphasizes the application of principles rather than their theoretical development.
>
> p 555 technology-industrial science: the science or systematic knowledge of the industrial arts, especially as applied to manufacturing.
>
> p 554 technician, engineering: a graduate of a technical institute course of study qualified to carry out in a responsible manner either proved techniques which are common knowledge among those who are technically expert in a branch of engineering or those techniques which are specially prescribed by professional engineers; may also supervise the work of others.

In the Dictionary of Occupational Titles (Volume 1 [6]Definition of Titles) 3rd Edition, 1965. GPO. I found a more specific definition of the Agricultural Engineering Technician (profess. and kin.) 013.181. Applies biological and engineering knowledge and methods, and technical skills in support of agricultural engineering activities, such as design of farm machinery, design and construction of irrigation, power, and electrification systems; soil and water conservation; and processing agricultural products.

The definition of an "agricultural engineer" is also included. As you know these code numbers and job descriptions are used extensively by government employment agencies to classify workers processed for jobs.

This book is the "Bible" of the trade. Here is the definition which includes much descriptive information as follows.

Agricultural Engineer (profess. and kin.) 013.081. Applies engineering technology and knowledge of biological sciences to agricultural problems concerned with power and machinery, electrification, structures, soil and water conservation, and processing of agricultural products; develops criteria for design, manufacture or construction of equipment, structure, and facilities. Designs and uses sensing, measuring, and recording devices and instrumentation to study such problems as effects of temperature, humidity, and light on plants or animals, or relative effectiveness of different methods of applying insecticides. Designs and supervises erection of structures for crop storage, animal shelter and human dwelling, including light, heat, air conditioning, water supply, and waste disposal. Plans and directs construction of rural electric power distribution systems, irrigation, drainage, and flood-control systems for soil and water conservation. Designs and supervises installation of equipment and instruments used to evaluate and process farm products, and to automate agricultural operations.

Of course Farral[2] and Albrecht shortened it considerably with the following:

> Agricultural Engineer - One who applies engineering science to the solution of problems of and to research in power, machinery, structures, land development, soil and water management, and electrification, in connection with the production, processing, handling, and storage of food, feed, and natural fiber.

They[2] also had a brief definition of agricultural engineering:

> Agricultural Engineering - A field of engineering in which both physical and biological sciences are specifically utilized, involving power, machines, structures, electronics, land development and soil and water management, dealing with the production, processing, handling, and storage of food, feed, and natural fiber.

However they[2] did not include a technician or a technologist or other educational terms. Therefore, I pursued some of these further in the Dictionary of Education[3] as follows:

> lesson: (1) a short period of instruction devoted to a specific limited topic, skill, or idea; (2) the materials to be studied before or during such a period; (3) what is learned during such a period of instruction.

Then I looked for "module" but it was not included. Therefore I called the Center for Research and Leadership Development in Vocational and Technical Education at the Ohio State University and obtained the following from Dr. Edward Morrison, Research Coordinator:

Module - a self contained instructional package, normally intended for use by the student without the help of an instructor.

In the July, 1966 issue of "The Agricultural Education Magazine" H. M. Hamlin[7] in trying to clarify the distinction between a "module" and a "unit" reported as follows:

> The distinction between a "module" and a "unit" as these terms are used in education is that a module may be a unit within any of several courses while a unit is an integral part of one course only. A module may be included in a course for twelfth grade boys or a two-year curriculum in an area school, or it may be taught as a separate course for young or adult farmers. It may be a part of a course in agricultural business, or horticulture, or agricultural mechanics.
>
> There are advantages in the preparation of materials that can be used in several courses. Whether they will be so used depends upon the teachers but a variety of uses is at least suggested.
>
> "Module" is a term long used in carpentry, electricity, and hydraulics. Webster gives additional definitions different from those used in these three fields. As we are using it in education, it parallels most closely the use in carpentry, where a module is a self-contained unit which can be fitted into buildings or furniture of many types.
>
> There are the same difficulties in the use of "module" that have been encountered when education has adopted other terms from outside its field. "Objective" does not have the same meaning for educators as for military men. "measurement" is quite different in engineering than in education. "Project," widely used by others, has taken on a special meaning in agricultural education.
>
> I do not smell heresy in the use of the new term. It has certain advantages if understood.
>
> The Editor replied: Thanks very much for continuing to try to teach me. I think that I understand the term, but it still seems to be the same as a Resource Unit-an interchangeable unit.

Now back to the Dictionary of Education[3] where about forty variations of the word "unit" may be found. Here are a few:

> p 587 unit: (1) a major subdivision of a course of study, a textbook, or a subject field, particularly a subdivision in the social studies, practical arts, or sciences. (2) an organization of various activities, experiences, and types of learning around a central problem or

purpose, developed cooperatively by a group of pupils under teacher leadership; involves planning, extension of plans, and evaluation of results; see projects; etc.

p 588 unit, subject matter: a selection of subject matter, materials, and educative experiences built around a central subject matter area; to be studied by pupils for the purpose of achieving learning outcomes that can be derived from experiences with subject matter.

p 587 unit, instructional: any part or division of a course that can be considered as complete in itself and can be taught as a whole.

p 587 unit, learning: a series of organized ideas and activities planned to provide worthwhile experiences for an individual or a group and expected to result in desired outcomes.

p 466 resource unit: (1) a comprehensive collection of suggested learning and teaching activities, procedures, materials, and references organized around a unifying topic or learner problem, designed to be helpful to teachers in developing their own teaching units appropriate to their respective classes; includes more than any one teacher could implement; typical content: desired outcomes, learn experiences, suggestions for starting, developing and conducting the unit, evaluation and reference lists for pupils and teachers; dist. f* unit teaching (see previous listing) - - - in this sense resource unit and teaching. Unit may be identical.

p 588 unit, teaching (1) see unit (1) and (2); (2) the plan developed with respect to an individual classroom by an individual teacher to guide the instruction of a unit of work (syn unit (3)) to be carried out by a particular class or group of learners; dist. f* resource unit.

p 416 program (1) a plan of procedure; (2) (voc. ed.) All the courses in one field of study, such as business education or industrial trades, organized to fulfill the same general objectives and conducted along similar lines.

p 421 project: a significant, practical unit of activity having educational value and aimed at one or more definite goals of understanding; involves investigation and solution of problems and, frequently, the use

---

* dist. f. = distinguish from

and manipulation of physical materials; planned and carried to completion by the pupils and teachers in a natural, "real life" manner.

You would expect all of us might agree on a definition of training but the Dictionary of Education[3] reports:

p 575 training: a process of helping others to acquire skills and knowledges without reference to any great meaning for the individuals learning to perform the skills or to verbalize the knowledges, these being performed at the instance of conditioned cues.

This sounds like an animal act for the circus. Therefore, I made a hasty review of a Manual for Navy Instructors[8] which provides the military approach as follows:

p 8 training - is the process of adjusting the trainee to make him function in a desired manner.

p 9 Training is done to develop one or both of two things: A pattern of thinking or a pattern of acting -- in either case it is necessary that the trainee take an active part in the proceedings. If the objective is to develop an attitude (a pattern of thinking), the trainee must think: if the objective is to develop a skill (a pattern of acting), the trainee must perform the task.

Next I returned to the Dictionary of Education[3] for some more familiar terms and found:

p 371 objective: n. aim, end in view, or purpose of a course of action or a belief; that which is anticipated as desirable in the early phases of an activity and serves to select, regulate and direct later aspects of the act so that the total process is designed and integrated.

Today however, especially in the teaching of skills and related information we are concerned with behavioral objectives which Jones[9] defines:

p 29 behavioral objective - is one that is stated in a form that requires specification of what students are to do under what conditions and how such behaviors are to be evaluated. (Haberman, Martin "Behavioral Objectives" Bandwagon or Breakthrough" Journal of Teacher Education Vol. 19 Sp. 1968.) There is also an implication that there is a logical sequencing of specific behaviors, one upon the other, that culminates in a major generalization or complex skills.

Jones[9] later cautions that:

p 31 Behavioral objectives may lead the teacher toward an over emphasis on skills (which are more easily specifiable) and an under-emphasis upon the development of interests, positive attitudes and generalization that are more difficult to pinpoint, but may be more important in the long run than the learning of content.

One definition of agricultural mechanics education which includes behavioral objectives might be:

Agricultural mechanics education: the bringing about of desirable changes in prospective agricultural education majors, measured in behavioral outcomes, namely: knowledge, skills, understandings and positive attitudes in the following technical subject matter areas:

1. power and machinery; 2. structures and environment; 3. soil and water management; 4. electric power and processing; 5. construction and maintenance; 6. food engineering.

One other term from The Dictionary of Education[3] which we often philosophize about is "transfer of learning" which is shown as having two components:

p 579 transfer of learning: syn, transfer of habit; transfer of training.

p 579 transfer of training: the influence that the existence of an established habit, skill, idea or ideal experts on the acquisition, performance or relearning of another similar characteristic; such influence may facilitate new learning (positive transfer), retard or inhabit new learning (negative transfer), or be of negligible effect on new learning, (zero or indeterminate transfer).

p 579 transfer of habit: (1) tendency for a practiced function to persist; perhaps related to functional autonomy; (2) the tendency for a practiced function to influence the formation and development of new functions; syn, transfer of learning

Perhaps Jim Hensel[10] summed up the dilemma of definition in the September, 1969 issue of Agricultural Education in a letter to the editor as follows:

Dear Cayce:

I am glad to see someone attempting to stir up some concern over the instructional areas in agriculture. No thesaurus of agricultural terminology or compilation of definitions will satisfy everyone. Overlap between categories will always be with us,

terminology or certain words may mean one thing in Georgia and another in Oregon, and pressures and politics will tend to influence any "official document." Therefore, we need to generate some discussion of the current efforts in this direction before the tentative lists become permanently cast in bronze.

Each time the list of instructional areas is reviewed by a different group, we find changes being offered and up to a point this is good. However, at some point in time we need to "get on with the show" remembering that it is much easier to pick someone else's list apart than it is to come up with a better one. Further, it is one thing to devise terminology which agricultural educators can agree upon and another to gain consent from all other vocational services and the many vested interests prior to publication and dissemination.

I would strongly suggest that we meet the problem head on by including a discussion of the tentative instructional areas in agriculture during future agricultural conferences. Perhaps we even need to consider changing some laws since they may constitute a major deterrent in establishing high school vocational agriculture programs which are specifically oriented toward preparation for college.

I share your concern and as a member of three committees which struggled with the problem, I sincerely hope we can come up with a universal agreement concerning the format for instructional and occupational areas in agriculture.

James W. Hensel, Specialist

List of References


1. ASAE Committee on Instruction in Agricultural Mechanization - "Report IV-Agricultural Phases of Teacher Education in Agriculture," Agricultural Engineering Journal, Vol. 49, No. 3, pp. 148-151, March 1968.

2. Farrall, Arthur W., and Albrecht, Carl F., Agricultural Engineering, A Dictionary and Handbook, The Interstate Printers and Publishers, Inc., Danville, Ill., 1965.

3. Good, Carter V., Dictionary of Education, 2nd edit., McGraw-Hill, New York, 1959.

4. Shoemaker, Byrl R., "What is a Technician," p. 21, Report of a National Seminar on Agricultural Education - Preparing Agricultural Technicians, The National Center for Advanced Study and Research in Agricultural Education, The Ohio State University, Columbus, Ohio, July, 1964.

5. Brum, Herbert D., "Non-Farm Agricultural Employment Opportunities and Training Needs in Ohio," Unpublished Ph.D., dissertation, The Ohio State University, 1965.

6. U. S. Dept., Labor, Dictionary of Occupational Titles, Vol. 1, Definition of Titles, 3rd ed., G.P.O. 1965.

7. Hamlin, Herbert M. "Letters to the Editor," Agricultural Education Magazine, p. 11, Vol. 39, No. 1, July, 1966.

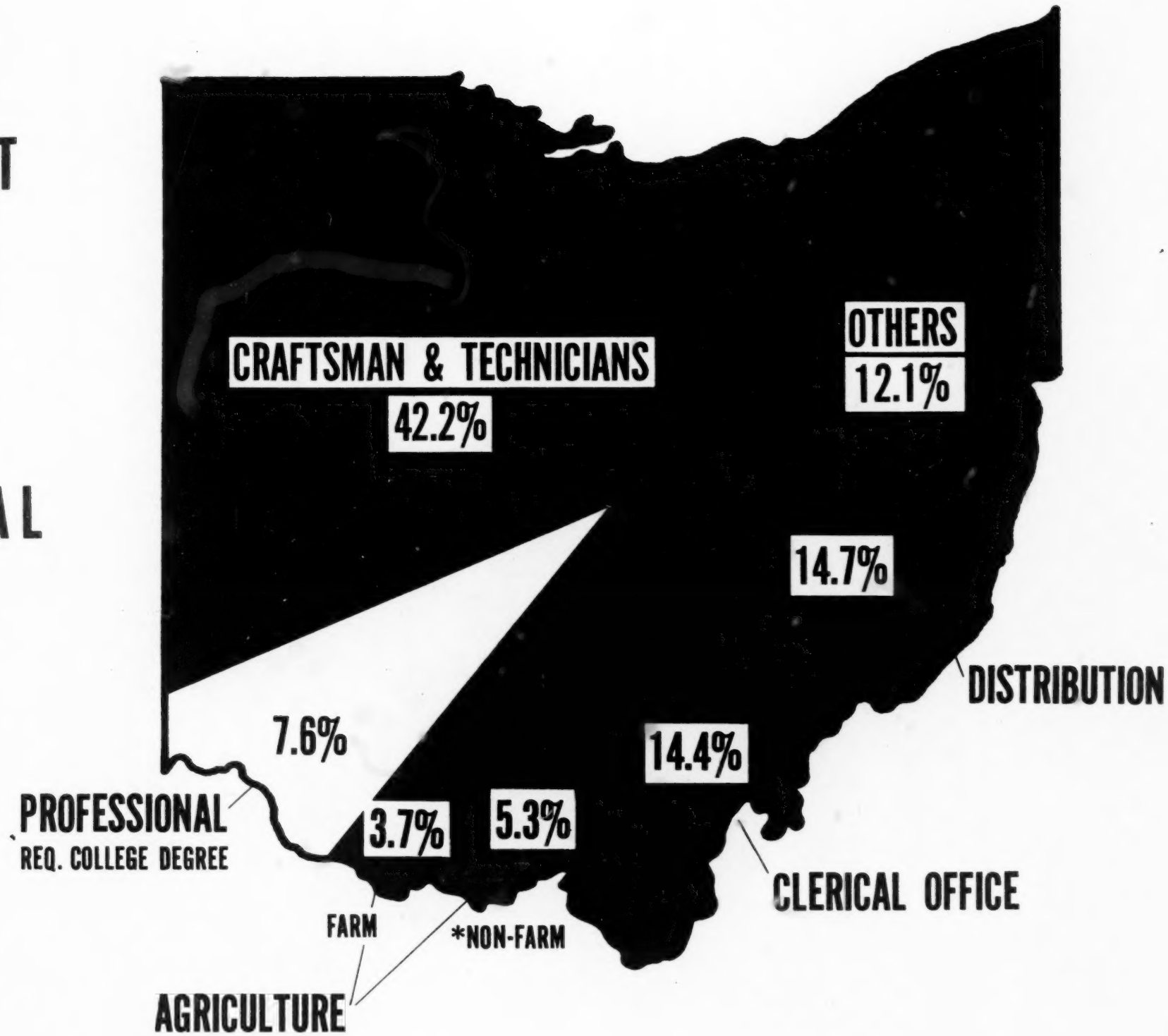
8. Manual for Navy Instructors, NAVPERS 16103-B, April, 1949.

9. Jones, R. Stewart, "Instructional Objectives and College Teaching," Approaches to Improved Teaching-Learning Outcome, Symposium on Improvement in Instruction, North Central Region, College of Agriculture. Published by Univ. of Ill., June, 1969.

10. Hensel, James W., "Letters to Editor," Agricultural Education Magazine; p. 53, Vol. 40, No. 3, Sept. 1967.

FIGURE I

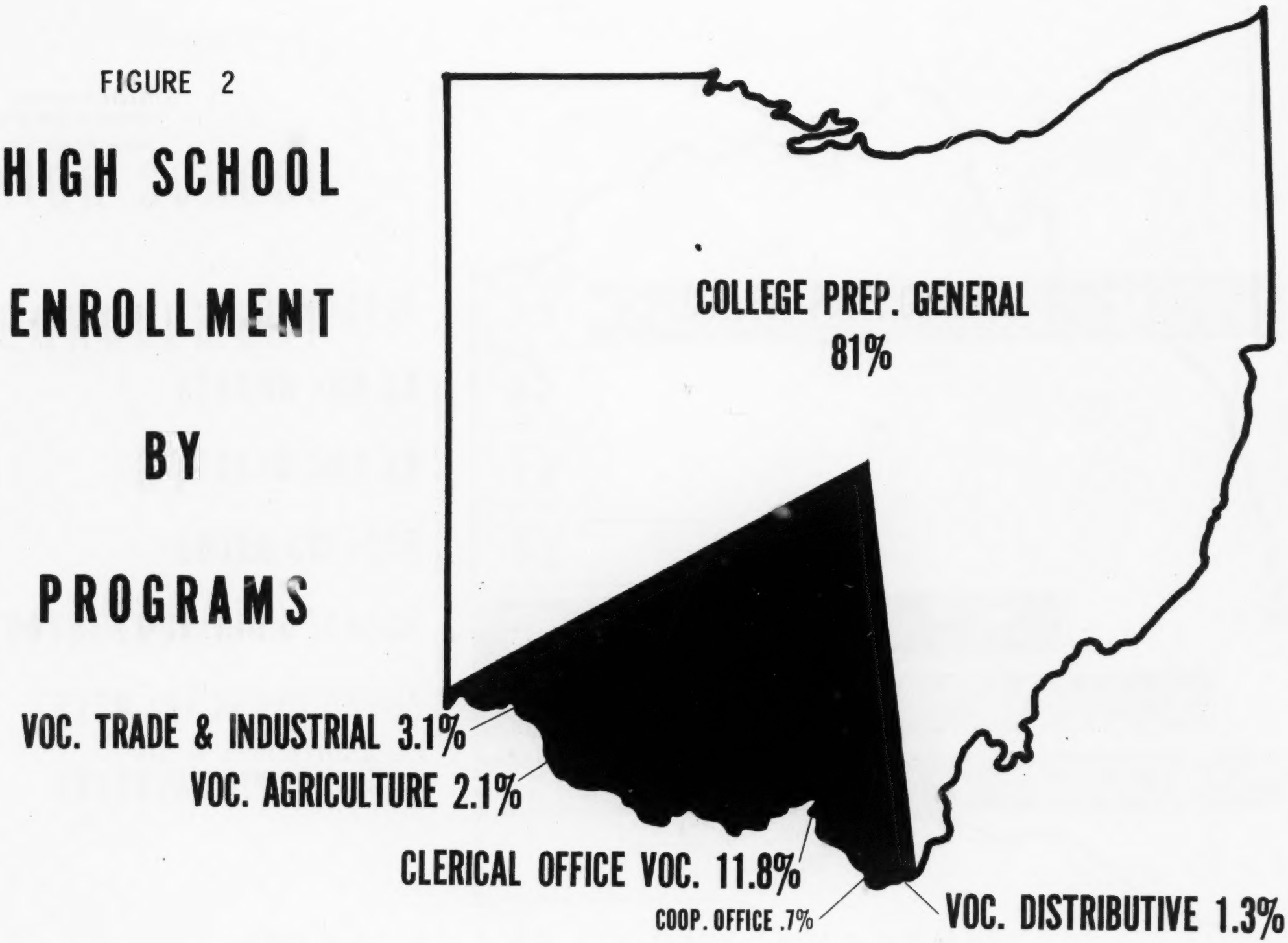
# EMPLOYMENT BY OCCUPATIONAL AREAS




Source: U.S. Census - 1960
*STATE DEPT. ED. STUDY

FIGURE 2

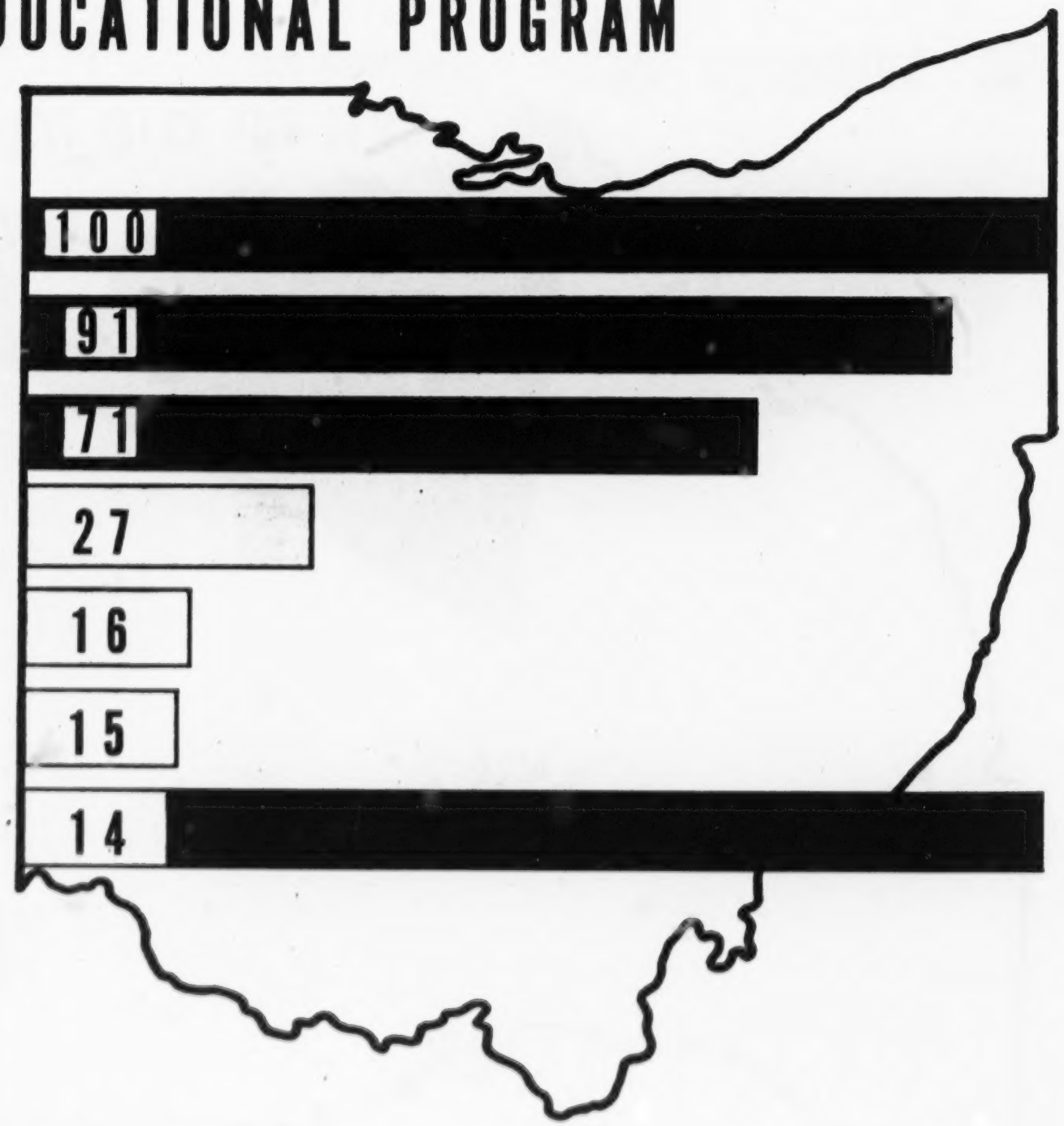
# HIGH SCHOOL ENROLLMENT BY PROGRAMS




Source: State Dept. of Educ.

FIGURE 3

# OHIO'S EDUCATIONAL PROGRAM




Source: State Dept. of Educ.

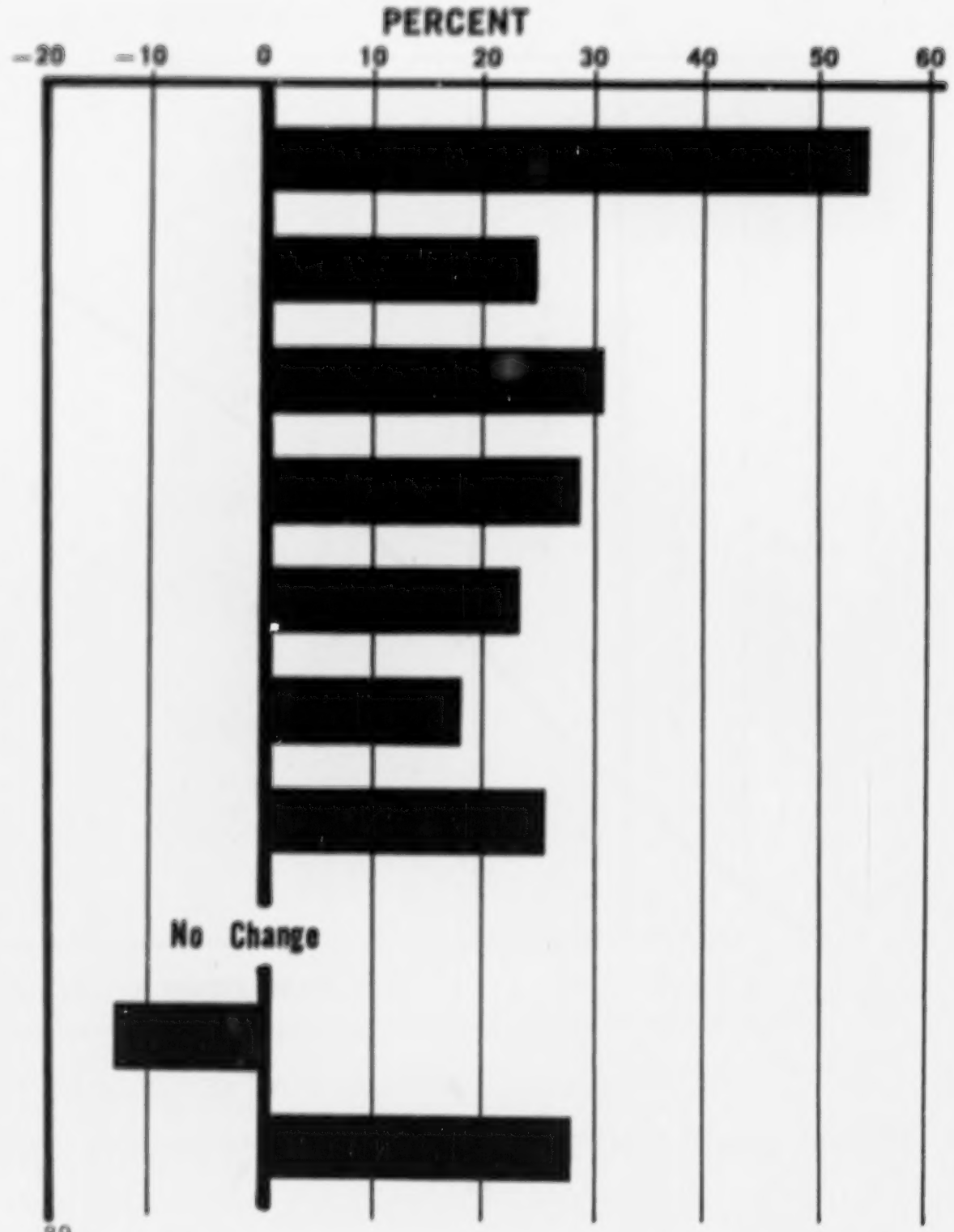
State Dept. of Education
School Year 1963-64

FIGURE 4

## PERCENT CHANGE IN EMPLOYMENT IN OHIO — 1960-1970

**OCCUPATION GROUP**

1. PROFESSIONAL AND TECHNICAL
2. MANAGEMENT
3. CLERICAL
4. SALES WORKERS
5. CRAFTSMAN
6. OPERATIVES
7. SERVICE WORKERS
8. LABORERS
9. FARMERS, FARM WORKERS
10. *NON FARM AGRICULTURE




SOURCE: OHIO BUREAU OF UNEM. COMP.
*STATE DEPT. ED. STUDY

FIGURE 5. DESCRIPTION OF A TECHNICIAN. COLUMBUS (OHIO) AREA TECHNICIAN SCHOOL

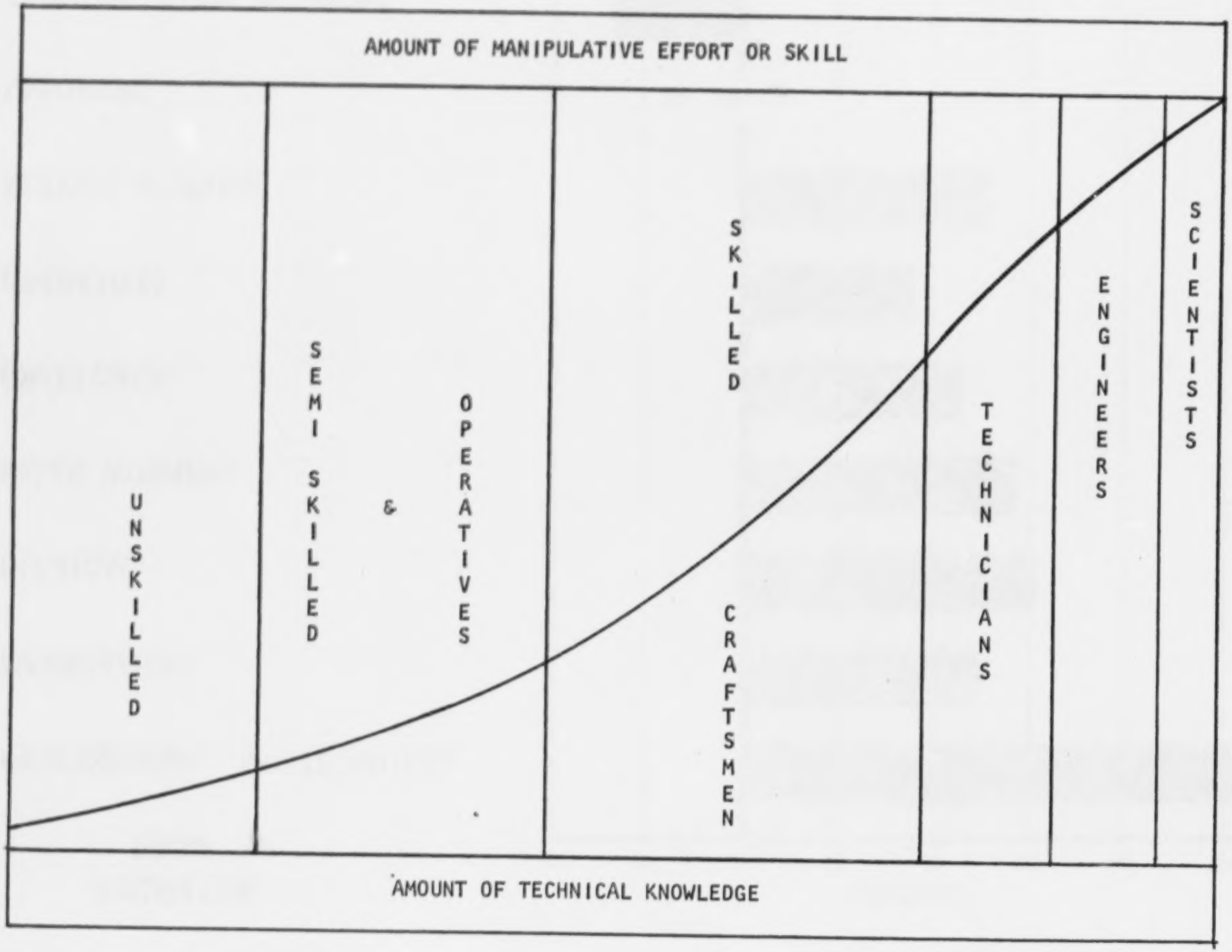
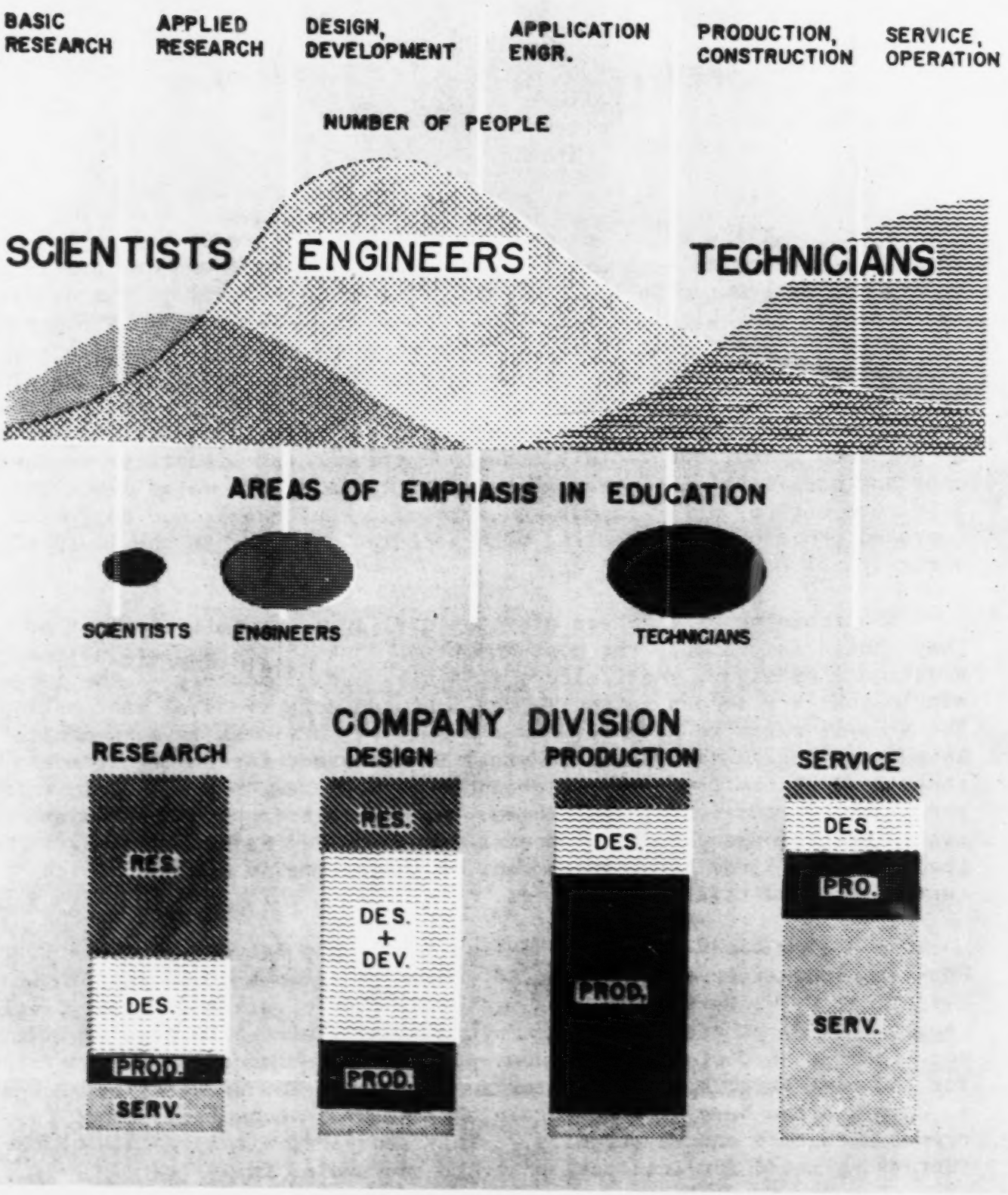


FIGURE 6. SPECTRUM OF TECHNOLOGY BY JOB FUNCTION*




*Smith, Marion L. "The Team Scientist, Engineer, Technician," Mechanical Engineering, p. 27. March, 1963.

# SUGGESTED COURSES IN AGRICULTURAL MECHANIZATION FOR AGRICULTURAL EDUCATION GRADUATES ON THE COLLEGE LEVEL

R. R. Harris
Department of Agricultural Engineering
College of Agriculture
University of Georgia
Athens, Georgia

Vocational and technical education in agriculture is basically concerned with below college-level instruction for people who can profit by it and are interested in the broad industry of agriculture. The needs of these people vary widely; therefore, a number of instructional programs are offered. Vocational teachers instruct disadvantaged, handicapped, exploratory, pre-vocational, and vocational groups in secondary schools. They also teach special vocational, young farmer, adult farmer, and post-secondary school groups. Even though specific objectives have been set up for each group, our rapidly changing agricultural situations warrant constant modification of them if needs of trainees are to be met. This Institute has certainly emphasized some of these changes and suggested improved procedures for dealing with selected problems in the field of agricultural mechanics.

The training of teachers of vocational agriculture to perform as they should is probably the most important link in the success of the vocational endeavor. Agriculture is a big, broad industry -- the largest single industry in our nation -- and includes many areas of instruction. The area in which we have devoted our efforts this week is agri-mechanics. This area is also recognized as vital in the other instructional areas of vocational agriculture such as production, supplies, resources, forestry, ornamental horticulture, and others. According to reports from many states and recommendations of specialists, a large number of vo-ag teachers spend from 50 to 65 percent of their time in agri-mechanics instruction and related activities.

In a 1970 study entitled, "Interrelationship Between Farm and Non-farm Industries with Special Reference to Area 4a of Georgia," researcher W. W. Harper, an economist with the Georgia Experiment Station, reports: "The prospects for the future of agriculture in Area 4a (19 counties) is that of a farm economy premised on a labor supply furnished, for the most part, by the operator's own labor. The operator will need to have a broad base of training in agricultural technology, which includes mechanics and electronics." This study definitely points up the increasing needs for instruction in agri-mechanics in my state.

Agri-mechanics is a term that certainly describes below college-level instruction. The word "shop" must not be used, because it neither

---

A paper presented at the Summer Institute in Agricultural Education for Southern Region, Virginia Polytechnic Institute, Blacksburg, 1970.

has a good public image in general education circles nor indicates the true nature of the instructional program.

To identify college-level courses in which students learn the application of established principles, practices, and techniques of engineering to the agricultural industry, most colleges and universities prefer a term such as Agricultural Mechanization, Agricultural Mechanization Technology, or Agricultural Engineering Technology. Since agricultural engineering departments normally assume major responsibility for this instructional program, administrators and instructors feel that these terms better indicate the breadth and depth of the science and technology included in the courses. In most schools students majoring in agriculture, mechanization technology, and vocational agriculture take the same courses.

College offerings should be broad enough to prepare teachers in technical mechanization. If 50 or more percent of the vo-ag teacher's time in the future will be spent in agri-mechanics, then a considerable amount of college training in applied engineering is needed. A simple analysis of essential subject materials needed to prepare a teacher for agri-mechanic instruction indicates that 40 of the 60 quarter hours listed in this paper should be minimum in the undergraduate program. In many instances teachers will need instruction beyond the baccalaureate degree. Advanced courses on the graduate level and non-credit workshops should be available for broadening and updating the teachers.

The ASAE Committee on Education in Agricultural Mechanization reports that Agricultural Engineering Departments normally recognize five areas of training. In this paper these areas are used only as a guide for developing basic courses for teachers. To reduce redundancy the general objective for each of the suggested courses is for the learner (pre-service or in-service teacher) to develop basic understandings, manipulative skills, appreciations, and attitudes for making decisions, and for using proper terminology, equipment, and scientific principles and techniques. Specific objectives are sometimes stated or implied, but no special effort is made to identify all of them.

There are two phases of Agricultural Mechanization that seem to be basic to all the others in that they are used repeatedly in making decisions and performing operations. They are: (1) Planning Projects, and (2) Selecting and Processing Engineering Materials.

Since detailed plans are essential for most jobs in agri-mechanics, the teacher must be able to teach the making and using of plans for a project. To meet this need the following course is recommended.

GRAPHICS AND PROJECT PLANNING. Basic elements of graphics and drawing, finding standard-practice plans, interpreting plans, modifying plans, developing new plans, evaluating special plans, and making a bill of materials for the project.

As students construct, repair, or maintain a project, the agri-mechanics teacher must teach selecting and processing the engineering

materials from which they are made. Materials used most are metals, woods, plastics, concretes, and concrete blocks. Each material must be processed or worked to a specified shape, size, and surface finished with tools and/or machines. Then the pieces of materials must be assembled and jointed into a finished product. I have chosen to call these college-level courses in engineering materials, Material Science and Technology. To train a teacher for this work the following mechanization courses are recommended.

MATERIAL SCIENCE AND TECHNOLOGY - I. Cold Metals. This course would include: science of metals; production of iron, steel, copper, aluminum, and others; identification of metals; non-precision and precision linear and angular measurements; layouts of projects using applicable mathematical principles; shaping metals by chip removal and forming; fastening metal parts; cleaning, protecting, and decorating metal surfaces.

MATERIAL SCIENCE AND TECHNOLOGY - II. Hot Metals. (Soldering, gas welding and cutting, and arc welding) Study areas are: science and properties of hot metals; science and characteristics of gas flames and electric arcs; science and properties of heat treated metals; shaping metals by heat forming and cutting; methods and techniques of fastening by soldering; methods and techniques of fastening by welding; hard-surfacing; cleaning and protecting hot metal surfaces.

MATERIAL SCIENCE AND TECHNOLOGY - III. Woods, Plastics, and Composite Materials. Study areas are: science, mechanical properties, and uses of each material; processing each material to size, shape, and surface finish; assembling and fastening joints; cleaning, protecting and decorating the surface of the material.

The agricultural industry depends largely upon chemical-energy machines for mobile power. With the scarcity of efficient and economical labor, the industry is becoming highly mechanized and automated in order to obtain maximum efficient production. To this end many well-known agronomists, horticulturists, and engineers are saying that if a commercially grown crop cannot be harvested by machine, it will not be grown in the United States after 1980. If this is our future, teachers need to acquire many basic understandings and skills in this phase of agri-mechanics.

Today the small air-cooled engine and associated equipment are effectively serving the agricultural industry in numerous ways. These machines are increasing in fantastic numbers because of their low initial and operating cost, maneuverability, and simplicity of design and operation.

All of these power units and related equipment will perform efficiently only if used, operated, and maintained properly. To deal with large and small power units and machines, the agri-mechanics teacher must know the principles of operation, maintenance management, safety, and the how's and why's of repair and operation of these machines.

The following college courses should be taken by the teacher to develop minimum basic understandings and manipulative skills in power and machinery.

AGRICULTURAL POWER AND MACHINERY. Study areas are: identification and characteristics of power sources and types; fuels and lubricants; principles of engine operation; tractor chassis, components, and accessories; power transmission and measurements; hydraulics; control systems; tractor selection, cost, operation, safety, care, and maintenance; analysis of engine performance with a dynamometer; adjustments and simple repairs.

The machinery study should include: mechanics of machines; principles and characteristics of operation; power transmission; selection, maintenance, costs, safety, repair, and care of equipment.

SMALL POWER UNITS AND EQUIPMENT. This course would include: unit selection, principles of operation, repair and maintenance, and operation and care of small air-cooled engines, small tractors, garden and turf equipment, chain saws, tillers, and selected recreational equipment.

Colleges should have graduate training courses for teachers in this area of mechanization. Two suggested courses are "Modern Power Mechanization" and "Modern Machinery Mechanization." To meet a specific need for a group of teachers, a non-credit workshop dealing with a particular crop or machine should be offered. An example of this is "Strawberry Mechanization."

In our society the use of electricity for agricultural purposes as well as for family living and recreation continues to increase by the year. Its characteristics make it a highly desired source of energy for most fixed power units and many portable pieces of equipment on the farmstead.

To help his trainees use electricity most beneficially, the agrimechanics teacher must have an understanding of basic terminology, principles, characteristics, and appropriate applications of electricity. He must acquire the ability to plan elementary wiring systems, to install simple circuits, to connect and use electric motors for power, to select and maintain electrically operated equipment used on the farm and in the home, to select and use electrical controls for mechanized systems, and to determine costs for performing designated tasks.

The teacher of the future must develop the ability to use special speed controllers for motors and sensoring devices for moisture, air, light, heat, temperature, pressure, etc. Remote electronic guidance systems for tractors and other equipment will also become a unit of his instruction. To prepare teachers for these instructional activities, the following courses are recommended.

ELECTRIC SYSTEMS AND MACHINES. Units of study include: basic circuits and circuit elements, electric wiring systems, motor operation and maintenance, magnetism, electric controls and motors, lighting, cooling, and heating.

ELECTRONIC CIRCUITS AND DEVICES. Study areas are: solid state speed controllers for motors; electric fence controllers; photo-electric devices and circuits; sensor electronics; controls for drying; laser beam and its applications.

To produce for our expanding population, we must obtain maximum production by manipulating our environment. Along with appropriate seeds, fertilizers, cultural practices, and insect and disease controls, water management is absolutely essential for optimum production. Not only must our soil and water resources be used wisely, but pollution of them must also be managed with great intelligence. Stream regulation and water treatment for re-use are fast becoming an integral part of our health and conservation programs. To assist his students to deal intelligently with these problems, the agri-mechanics teacher must know the fundamentals and applications of soil and water resource technology along with water movement and control. The following courses will be needed to permit the learner to acquire these basic understandings and applications.

SOIL AND WATER RESOURCE TECHNOLOGY. Study units include: ecological relationships, hydrology and water resource development, erosion practices and controls, practices for maintaining soil capability, pollution abatement, and use of instruments for land and water measurements.

WATER MOVEMENT AND CONTROL. Units of study include: fundamentals and installation practices for irrigation and drainage systems, advanced land and water measurements, domestic water systems.

A structure is often considered as being something constructed or erected. In the agricultural industry, structures normally consist of buildings, parts of buildings, constructed equipment, or convenience and utility devices.

Buildings must provide for optimum production, keeping qualities of stored products, efficiency of operations, and sanitary and comfort conditions. Smaller structures, such as farm fences, waste disposal units, and utility devices, contribute greatly to the attainment of our agricultural goals. Since older groups of vocational trainees often become concerned with problems in this area of agricultural mechanics, the teachers must be able to deal with the planning, construction, and maintenance aspects of simple structures. In addition to a course in small structures, a second one is highly recommended for those teachers who work with the mechanization of a special building or of all buildings on a farmstead.

SMALL STRUCTURE CONSTRUCTION. This course includes: planning and construction methods for small buildings made of lumber, poles, metals, concrete, blocks, and plastics; bill of materials; carpentry of layouts, foundations, framing, floors, coverings, and finishes; planning and building fences, simple waste disposal units, and farm and home improvement and supplementary projects.

FARMSTEAD MECHANIZATION. Units of study are: principles and practices used in planning and constructing specific plant, livestock, and storage buildings constructed from any of the modern engineering materials; environment control systems; feeding and watering systems; product processing and materials handling systems; management and maintenance of buildings and systems.

In some states educational leaders are predicting that five years of college training will soon be required of all beginning teachers. For such programs all of the above courses, both undergraduate and graduate, should become a part of the vo-ag teachers' training in agri-mechanization. This will permit them to develop the technical breadth and depth that beginning teachers need in our modern and changing agriculture. In the meantime, the contents of college instruction must be adjusted in quantity and quality so that teachers of vocational education in agriculture can be prepared for a successful role in agri-mechanics tomorrow.

# IT'S DECISION TIME

T. J. Horne
Project Director
Agricultural Sciences
Southern Regional Education Board
Atlanta, Georgia

## Society's Failure

In moving out of the classroom and away from the university campus one loses the close contact with the day to day involvements in teaching. On the other hand it enables one to develop a broad perspective concerning the problems of our society. From the vantage point of directing regional programs it seems to me that four interconnected threats face the people of the states, the nation, yes, even the world. These four threats--war of mass destruction, overpopulation, pollution, and depletion of our resources--underlie the genuine concerns of our adults and youth. They are the result of the inadequacies of the generations to date to successfully manage these areas so they would effectively contribute to the further development of an environment favorable to mankind.

One has only to fly over our major cities or travel through America to see the cumulative effects of these threats. You can see our world burning as surely as if its total mass were on fire. Even though biological life can make adaptations to changes in its environment, we can see examples throughout this land in which accumulations of one or more of these threats have destroyed living things. How long can we let the accumulative effects of all these threats continue before they affect the total life process? We don't have the answer but we do know that the accumulative effects are so distorting the economies of nations and the psychology of the people that established governmental processes are diverting material and human resources away from the main goal of organized society, which is the nourishment of life and improvement of the environment on which life depends. The results of such diversions are decay of our cities, buildup of racial and national tensions, polluted air, water and earth, deteriorated housing, inflation contributing to continued poverty, and creation of conditions which could lead to massive hunger during the late 1970's. All of these are major contributors to fear and hatred which have led to explosions of organized violence in our cities and on our campuses.

To solve the problems created by the cumulative effects of these major threats, it seems to me that we need a major redirection of human energy, material and educational resources to the development of an environment conducive to the preservation of life. To achieve this we must enlarge the boundaries of what we have generally considered as the areas of research and education. This task will be greater than anything yet undertaken. The penalty for our continued failure in these areas over

a long period of time could result in major adaptations in life processes. These in turn could bring about a drastic alteration of the civilization that we have known.

## Education's Challenge

The enormity of the task facing education in the world of tomorrow is illustrated by the current practices in colleges throughout America. This fall, as he has for years, the teacher will begin his course with the expectation that about one third of his students will learn what he tells and assigns them, about one third will learn a portion of what he tells and assigns them and one third will fail or just get by. This system creates a self-fulfilling teacher prophecy. The students are manipulated through the grading process in such a way that they come out with grades approximating these expectations.

Such a set of expectations fixing the goals of teachers and performance of students is the most wasteful and destructive aspect of our current system of education. It tends to reduce teacher aspiration, destroy motivation for learning, is cancerous to the ego and self-fulfillment of students, frustrates learners and wastes human resources. The costs of such a system can no longer be tolerated by society.

Students admitted to college today have proven their ability to learn successfully and are capable of graduating. Why then do college teachers erode and destroy human resources by manipulating them into failing? There are three major reasons. College policies have evolved to support the system. Faculties have had little or no professional preparation for teaching and know little about the teaching-learning process or the variety of technologies available for use in aiding student learning. No acceptable standards of achievement have been established as a measure of successful teaching.

The work which you have been doing here in this institute is based upon the premise that students can learn and perform at acceptable levels of attainment. This takes away the crutch that has supported college teachers for decades in their mediocre levels of teaching and in failing excessive numbers of students. The challenge of helping all students learn successfully is frightening to them but to you this must become a reality.

## Expected Improvements

Your accomplishments during the week are only the beginnings. Changes are being made and will come more rapidly in the future. Soon we will have educational systems and institutions sharply focused upon predetermined major objectives and critical problems. They will be administered from the authority of genuine concensus and deep commitment to action on the part of administrative management, faculty and students. Their programs will be innovative, aimed at effecting a variety of changes designed to serve the individual student and society and increase

the effectiveness with which they use their resources. They will practice what they preach in their own programs. They will include at least four major areas of improvement.

Effective Educational Management--will include more effective recruitment and lifelong professional education of specialists in management, planning and teaching faculties; the development and application of measurements by which a system could be effectively planned, supervised and evaluated; the development of effective evaluations to enable both the system and the teacher to see where each has been, how each is doing and where each is heading; the development and dissemination of effective techniques of educational planning to determine the system's role and insure means of providing effective educational service to the people.

Effective use of Content and Method--will involve the determination of practical ways of using technologies in increasing learning. Teachers, materials and instruction will continually be updated to the frontiers of knowledge and technology. The logistics, structures and timetables of the system will be adapted to the varying needs of individual students.

Effective Teaching--will be the heart of the revised system. The traditional concepts of a teacher and of teaching will be altered to make teachers into directors of learning. New practices of evaluating, promoting and rewarding performance will be developed. All teachers will become involved in directing student growth and development through individual prescriptions.

Effective use of Resources--will improve the productivity of our educational system. The program of studies will be relevant or goal-oriented. More teaching materials will be used. Buildings will be designed to contribute to learning. They will be used day and night at the time, place and in the manner that will enable each individual student to learn most effectively.

## The Opportunity

It seems appropriate to remind you that society has benefited from the industrial, medical, transportation, communication and agricultural revolutions. The educational revolution has begun. Our efforts are devoted to speeding it on through developments in the four areas listed above. The people of your state and the nation are paying an exorbitant price by using our outmoded system which wastes our resources and manpower and frustrates our youth.

The beginnings you have made project you into a position of leadership in improving instruction in your state. You will have to run to keep

ahead of industrial agencies entering the field of education. Competition will be keen. In the future, those who can produce happy, well adjusted, superior educated youth will receive the resources to do the job and be rewarded for their efforts. You have entered the race. Each of you can be a winner on your own campus. There is little doubt that all of you will do a better job this year than you have ever done before.

Now you know that some of the better students are learning the equivalent of three grade levels in thirty hours of well organized, efficiently directed instruction. Educators can criticize all they want to but results speak for themselves and in your hearts you know it can be done. This knowledge will bug you into developing a "can do" attitude that will motivate you in doing a more effective job of directing learning activities on your respective campuses.

It's decision time for each of you. Can you do a more effective job in directing student learnings? The answer of the dedicated educator must be, "I will improve."

## CLOSING REMARKS

T. J. Wakeman

Friday, T. J. Wakeman, substituting for W. C. Boykin, who had to leave at 10:20 made the statement that many who had asked about the program stated that it was the best ever witnessed. Mr. Wakeman said it was the effort of Martha Hollandsworth, the Institute secretary, whom he introduced at the Conference, and Dr. Phil Mason. Here again the role of Dr. Mason in Agricultural Mechanics Education was emphasized. He took an average program and made this model one from it. "He took hours of his time to do this. Each and every move he makes is of this quality, trying to bring dignity to Agricultural Mechanics Education everywhere, the Departments of Agricultural Engineering and Agricultural Education and to Virginia Tech," said Professor Wakeman.

After Dr. Horne gave the Institute Summary it was agreed by the group that a new planning group be formulated by asking each present member to continue, or if he cannot continue to send the name of the person to take his place, to the present Institute Chairman. It was stated that much effort would be exerted by Dr. Horne and the Committee to continue the effort started at the Institute to write educational objectives for all areas of Agricultural Mechanics Education.

Dr. James A. Scanlon
Vocational Education Department
University of Arkansas
Fayetteville, Arkansas

Dr. Scanlon discussed what the Task Forces would be expected to accomplish, explained the reason for writing objectives and gave an example. The following chart was discussed.

Pre-requisites

1. oxy-acetylene
2. painting & finishing
3. sketching & drawing
4. power wood
5. hand wood
6. small gas engines
7. tool sharpening
8. cold metal
9. soldering
10. electricity
11. plumbing
12. arc welding
13. surveying
14. concrete

Subject Matter Areas

1. Farm Power & Machinery
2. Structures & Environment
3. Soil & Water Management
4. Electric Power & Processing
5. Agriculture Construction & Maintenance

Relate 14 pre-requisites to broad subject matter areas. Rationale is that we can relate things to the broad subject matter areas in order to know what to teach. If you can't relate pre-requisites to five subjects at right, don't teach them. If you can justify leaving any of the 14 pre-requisites out, do it, or if you cannot justify certain things or sections of the 14 pre-requisites, don't use them.

A student needs to have an objective in order to know what he is expected to accomplish.

A good idea is to give the student a sample to follow. Dr. Scanlon used arc welding as an example. He suggested that the student be given a sample to follow and the size electrode to use. If the student can run a bead equal to or better than the sample, he has accomplished the objective.

# TASK FORCE

# REPORTS

Edited by:

Dr. Walter A. Cameron, Consultant

Clemson University

Clemson, South Carolina



401
107

The following persons served as consultants to the task forces in the preparation of the objectives contained in this section:

Walter Cameron, Clemson University, Chairman

Robert F. Mager, Mager Associates

James A. Scanlon, University of Arkansas

Phil Teske, U. S. Office of Education

REPORT ON THE TASK FORCE

FOR

METALS

Members of the Task Force

C. J. Rogers, Chairman

George White, Reporter

Earl Beeman

George Cook

Howard Downer

Roland Harris

Curtis Shelton

John Bishop



109

Objectives Developed for the Area of Metals

1. The student will list and define in writing 10 of the 12 common properties of metals.

2. The student when given samples of the following metals will distinguish between them using combinations of the following metal identification tests: (1) visual, (2) spark, (3) magnetic, (4) chip, (5) fracture, (6) specific, and (7) acid.

   a. copper
   b. nickel and steel alloy
   c. low carbon steel
   d. medium carbon steel
   e. aluminum
   f. magnesium alloy
   g. malleable cast iron
   h. white cast iron
   i. wrought iron
   j. gray cast iron
   k. tool steel

   The student will demonstrate his ability to distinguish between the above metals by identifying 20 out of 25 samples of them.

3. From a list of the following metals the student will select the best metal and shape of metal to construct a utility trailer tongue:

   a. angle iron
   b. channel iron
   c. iron pipe
   d. strap steel
   e. T iron
   f. aluminum channel

   The student's selection will be evaluated with respect to cost, availability, and strength.

4. The student will temper a one inch wide cold chisel using a heat source and cooling medium selected by the instructor. The tempered cold chisel must be of good enough quality to cut through a 1/2" steel rod without cracking or dulling.

5. Given a piece of tempered high carbon steel, the student will anneal it to sufficient workability for shaping operations such as bending, twisting or cutting without cracking.

6. Given a twist drill that has been dulled by abusive use, the student will sharpen it using a power grinder. The sharpened twist drill must have its cutting lip restore to the original angle and must compare in cutting performance to a new twist drill of similar size.

7. Using a 1/2" round mild steel stock, hammer, anvil and a heat source selected by the instructor (e.g. oxy-acetylene, carbon arc torch, electric furnace) the student will form an eyebolt with a 2" diameter eye and a 3" long shank. The formed eyebolt must compare in dimensions and appearance to the sample eyebolt provided.

8. Given a variety of different brands and sizes, the student will identify by name, size (where applicable) and use the following measuring and marking tools:

| | | |
|---|---|---|
| a. Bench rule | d. micrometer | g. center punch |
| b. Four-fold rule | e. inside calipers | h. scratch awl |
| c. yard stick | f. outside calipers | i. 6' carpenter rule |

9. Given the proper measuring tools and the necessary materials, the student will lay out with a scratch awl a sheet metal project such as a funnel. The layout measurements must be within a tolerance of $\pm$ 1/32".

10. Given a 1/4" low carbon steel plate, power drill and a tap and die set, the student will prepare and thread a hole in the 1/4" plate to receive a 3/8" N. C. threaded rod. The threaded hole must be perpendicular to the base metal, have no broken threads and be smooth and clean as the sample provided.

11. Given a list of five different sizes in sixteenths between 1/16" and 1" the student will select the correct size twist drills, the correct size taps and the correct size dies to drill and tap 5 holes and to prepare threaded rods to fit the threaded holes. He must be 80% accurate in his selection.

12. The student will prepare and thread a 1/4" low carbon steel rod to receive a N. C. thread nut. The student will be provided with a tap and die set and all necessary working materials. The threaded rod must have clean, unbroken threads which compare in quality to the sample provided.

13. The student will demonstrate his ability to use a hand hacksaw by cutting a 2" square from the corner of a 1/4" 4" x 6" mild steel plate. The sawed edges must be smooth and perpendicular and the hacksaw blade must show no results of abusive use.

14. The student will finish a given welded metal project by removing all rust, slag and other foreign materials and coating it with a paint. The finished project must be evenly coated with paint, be smooth to the touch and be as attractive in surface appearance as the sample finished project provided.



60111

# REPORT OF TASK FORCE

# FOR

# SOLDERING

Members of Task Force

Robert T. Benson, Chairman and Reporter

R. C. Butler

Roland Espenchied

J. A. Hardy

Eldon E. Heathcott

K. D. Cook

Objectives Developed for the Area of Soldering

1. Given an untinned soldering copper with incorrect tip angle the student will prepare it for service. He will be provided with files, cleaning materials (steel wool, emery cloth, wire brush), 50/50 solid wire solder, pasteflux and a heat source selected by the instructor (e.g. oxy-acetylene torch, carbon arc torch, forge). The soldering copper prepared by the student will:

    a. Have a tip which is shaped to the original angle of a new tip.

    b. Be free of scale and corrosion.

    c. Have a tip coated with a thin coat of solder which is equal in appearance to the sample soldering copper provided by the instructor.

2. Given a manufacturer's instructional guide and an inoperative portable propane cylinder torch, the student will clean the torch and adjust it for use as a heat source for soldering. The manufacture instructions will be followed in sequence. The student must demonstrate to the instructor the proper operation of the torch after cleaning it.

3. The student will safely prepare and solder a 28 gauge 1" square sheet metal patch over a 1/4" diameter hole in a 28 gauge 3" square work piece. He will use 1/8" diameter 50/50 solid wire solder, paste flux and a heat source selected by the instructor (e.g.: portable propane torch, oxy-acetylene torch, carbon arc torch). The patch will be water and/or air tight and will be of equal quality to the sample provided.

4. The student will safely prepare and solder a 1/8" diameter in a 28 gauge 2" square piece of sheet metal. He will use 1/8" diameter 50/50 solid wire solder, paste flux and a heat source selected by the instructor (e.g.: electric soldering gun, electric soldering copper, portable propane torch). The soldered area will be air and/or water tight and be of equal quality to the sample provided.

5. The student will safely prepare and solder a 1/4" wide lap joint using 2 pieces of 2" x 3" 28 gauge sheet metal, 1/8" solid wire 50/50 solder, paste flux and a heat source selected by the instructor (e.g.: portable propane torch, oxy-acetyelenetorch, electric soldering copper). The soldered lap joint will be air and/or water tight and will be of equal quality to the sample provided.

6. The student will safely prepare and solder a 1/4" wide lap joint using 2 pieces of 2" x 3" 1/16" thick aluminum, 1/16" solid wire aluminum solder and liquid flux prepared for aluminum soldering. The soldered

joint will be free of gaps, porosity and oxides and compare in appearance to the sample joint provided.

7. The student will safely prepare and solder a 3/8" wide lap joint using 2 pieces of 1" x 2" 1/32" stainless steel, 1/8" solid wire stainless steel solder and liquid flux prepared for stainless steel soldering. The soldered joint will be free of gaps, porosity and oxides and compare in appearance to the sample joint provided.

8. The student will safely prepare and sweat a copper fitting on 1/2" rigid copper tubing. He will use a propane torch heat source, 1/8" solid wire 40/60 solder and a non-corrosive paste flux. The quality of the soldered fitting will be equal to the sample provided and will withstand an air or water pressure of 45 psi.

9. The student will safely prepare and sweat a stainless steel fitting on 1/2" stainless steel tubing. He will use an oxy-acetylene torch heat source, 1/16" silver solder and a silver solder flux. The quality of the soldered fitting will be equal to the sample provided and will withstand an air pressure of 90 psi.

10. The student will safely prepare and solder 2 pieces of 16 gauge stranded copper wire using a pigtail splice. He will use 1/8" diameter solid wire 50/50 solder, a non-corrosive flux and a heat source selected by the instructor (e.g.: portable propane torch, electric soldering copper). The soldered splice will withstand a pull that breaks one of the wire and will be equal in appearance to the sample provided.

# REPORT OF TASK FORCE FOR

# GAS WELDING AND

# CUTTING

Members of Task Force

F. W. Nicholas, Chairman

R. E. Powell

L. L. Crump

Ron Seibel

Lewis Eggenberger

Waverly Brown

Dean Sutphin

Objectives Developed for the Area of Gas Welding and Cutting

1. The student will select gas welding and cutting equipment to equip a secondary level agricultural mechanics shop. He will be provided with a list of a variety of welding and cutting equipment available, safety guidelines to be followed, number of students to be served and the cost of the various pieces of equipment that might be obtained. The selection of each piece of equipment must be justified in writing with respect to safety, cost and usability with high school students.

2. Using the manufacturer's instructions the student will assemble the components of gas welding and cutting equipment into an operational unit. All necessary tools and materials will be provided. The assembled unit must be completely operational, be free of leaks and meet the state's safety requirements.

3. Given a complete gas welding unit with the major parts labeled with a number, the student will identify by name the major part for each number. The major parts of the unit must be identified with 90% accuracy.

4. The student will be able to spell and define in writing with 80% accuracy the following terminology used in gas welding:

| | | |
|---|---|---|
| a. flux | e. reducer | i. brazing |
| b. orifice | f. oxygen | j. oxidizing flame |
| c. injection | g. acetylene | k. neutral flame |
| d. fusion | h. propane | l. carburizing flame |

5. The student will demonstrate and explain verbally the steps involved in turning on, lighting and adjusting an oxy-acetylene welding torch to a neutral, oxidizing and carburizing flame. He must perform the above in the presence of the instructor to the satisfaction of the instructor who will use a check list to evaluate each step.

6. The student will demonstrate and explain verbally the procedure for shutting off an oxy-acetylene welding torch. The procedure used must be in complete agreement with the procedure recommended by the manufacturer of the welding equipment.

7. Given samples of four types of gas welding flux, the student will select the correct one to be used for each kind of welding listed below:

   a. Brazing mild steel
   b. Hardsurfacing
   c. Aluminum welding

   He must be 100% accurate in his selection.

8. Given a tip and gas pressure selection chart, the student will cut a straight line through a 1/2" thick piece of gray cast iron using an oxy-acetylene cutting torch. The finished cut will be comparable to a sample cut provided with respect to straightness and smoothness.

9. Using a tip and gas pressure selection guide the student will select the proper welding tip, gas pressure and filler rod size for brazing 1/4" mild steel with an oxy-acetylene welding torch. He must be 100% accurate in his selection.

10. The student will explain verbally and demonstrate the preparation of mild steel for a butt weld. He will be provided with two 2" x 4" pieces of 1/4" mild steel and a power grinder. He must perform the above to the satisfaction of the instructor who will use a checklist to evaluate each step.

11. The student will run a bronze bead using flux, bronze welding rod, and oxy-acetylene welding tip on a 4" x 5" 1/8" thick sheet of mild steel. The bead must compare in appearance with respect to uniform width and ripple to a sample bead provided.

12. The student will make a bronze butt weld with an oxy-acetylene welding tip. He will be provided with flux, 1/8" bronze welding rod and 2 pieces of 3" x 4" 1/8" thick mild steel. The weld must withstand a 90° bend in a vice without breaking and must compare in quality to the sample butt weld provided.

13. The student will make a bronze fillet weld in the flat position using oxy-acetylene welding equipment. He will be provided with flux, 1/8" diameter bronze welding rod and 2 pieces of 2" x 3" 1/8" thick mild steel. The weld must withstand the straightening of the two pieces of metals without breaking and must compare in quality to a sample fillet weld.

14. The student will make a fusion lap weld with steel filler rod using oxy-acetylene welding equipment. He will use 2 pieces of 3" x 3" 1/8" thick mild steel. The lap weld must compare in quality to a sample lap weld.

15. The student will bronze two pieces of 1/4" thick gray cast iron in a flat position. He will use flux, 1/8" diameter bronze welding rod, oxy-acetylene welding equipment and a tip and gas pressure selection guide. The welded cast iron must be free of distortion and cracks and compare in quality to the sample provided.

16. The student will make a fusion butt weld between two pieces of 3" x 6" 1/8" thick mild steel with oxy-acetylene welding equipment. The weld must withstand bending up to 45° without breaking and compare in quality to a sample butt weld.

17. The student will demonstrate his ability to control a molten puddle by carrying a puddle of molten base metal 3/8" wide across a 3" x 6" 1/8" thick mild steel plate. He will use oxy-acetylene welding equipment and a tip and gas pressure selection guide. The melted ripple must compare in appearance to the sample provided.

18. The student will select the proper cutting tip and gas pressures for cutting both 1/4" and 1/2" mild steel with both an oxy-propane and an oxy-acetylene cutting torch. He will use a cutting tip and gas pressure guide. His selection must be 100% accurate.

19. The student will cut a 1" strip of metal off the end of a 3/8" thick 6" wide mild steel plate using an oxy-acetylene cutting torch. The cut edge must be straight and smooth. The 1" strip must be uniform in width within a tolerance level of $\pm$ 1/4".

20. Given a piece of 1/2" cast iron, a cutting tip and gas pressure selection guide, and oxy-acetylene equipment, the student will cut a perpendicular cut across the piece of cast iron. The finished cut will be straight, smooth and compare in appearance to the sample provided.

21. The student will use an oxy-acetylene cutting torch for pre-heating and heat treating metals. The instructor will use a checklist to evaluate the student's ability to apply heat and control it.

22. The student will hardsurface a plow share using both a hardsurfacing rod and flux and a hardsurfacing powder. He will use oxy-acetylene equipment. The hardsurfaced plow share must compare in quality to the sample provided.

23. The student will inspect and make minor repairs on oxy-acetylene equipment. He will use an inspection guide list. He must perform repairs such as splicing hoses, seal fitting, replacing pressure gauges and pressure gauge lens to the satisfaction of the instructor.

# OXY-ACETYLENE WELDING
(Outline)

I. Plan reading
II. Selecting equipment
III. Using safety practices
IV. Setting up equipment
V. Operating a gas welding torch
VI. Fusion welding without a rod
VII. Fusion welding with a steel rod
VIII. Welding with bronze rods
IX. Welding with cast iron rod
X. Hardsurfacing

## Cutting With Gas Oxy-Acetylene

I. Plan reading
II. Practicing safety
III. Selecting equipment
IV. Setting up equipment
V. Starting the torch
VI. Cutting steel
VII. Cutting holes in steel
VIII. Cutting cast iron

## Cutting With Oxy-Propane or Butane

Plan reading
Using safety practices
Selecting equipment
Setting up equipment
Starting the torch
Cutting steel
Cutting holes in steel
Cutting cast iron

REPORT OF TASK FORCE

FOR

ELECTRICITY

Members of Task Force

W. C. Boykin, Chairman

Hallard Randell, Reporter

G. H. Hetzel

M. E. Singleton

Lloyd Jacks

Ed Henderson

Steve Bell

C. B. Jeter

Curtis Corbin

James T. Craig

Objectives Developed for the Area of Electricity

1. Given a set of building plans with electric equipment size and location indicated, the student will determine the number and placement of power outlets and switches needed. The student must be 80% accurate in regard to the following:

   a. One number 12 wire circuit must be provided for each 10 general purpose outlets.

   b. Wire size selected for each special purpose outlet must not allow for over a 5% drop in voltage.

   c. Lights must be located in accordance with Edicon Electric specifications.

   d. Service entrance must provide for both 120 and 240 volts.

   e. Service entrance capacity must exceed total capacity of circuits by 25%.

   f. Service entrance must be located as close to center of heaviest load as possible.

The student may use all available references.

2. Given materials and location, the student will install a single pole switch to control an overhead light in a home. The installed switch must reflect the following characteristics:

   a. No more than 1/4" bare wire at terminals.

   b. Wire and insulation not physical damaged.

   c. Outer insulation must extend 1/2" into box.

   d. Proper wires connected to proper terminals on switch.

   e. Switch must be flush with wall.

   f. Switch installed so that "off and on" are right side up.

   g. Switch must control current to light.

3. Given materials and locations for installation, the student will install a 4-way switch to control overhead lights in different rooms. All connections must be made in accord with the electrical code and the switches must control current to lights in the specified sequence.

4. Given materials and a pictorial wiring diagram, the student will install a single pole switch and 3 light fixtures for one room. The completed lighting circuit must meet the standards of the electrical code and must function as specified.

5. Given a set of electrical circuitry plans and building plans for a home, the student will develop a bill of materials for a 30 amp special purpose circuit to be installed in the garage. He must be 80% accurate in specifying the following:

   a. Overload device
   b. Size and length of wire needed
   c. Outlet type and capacity
   d. Connectors and fasteners needed

6. Given a set of electrical circuitry plans and building plans, the student will draw a schematic diagram for adding a 30 amp special purpose circuit to be located in the garage. The schematic diagram must meet the instructor requirements with respect to:

   a. Electrical symbols
   b. Dimensions and specifications
   c. Special procedures
   d. Location of wiring

7. Given a 100 amp service entrance box and the necessary materials, the student will install the box to serve 2 general purpose circuits, 2 lighting circuits, and 3 special purpose circuits. The installation must meet the requirement of the electrical code and the connections made must compare in quality to the sample installed service entrance box provided.

REPORT OF TASK FORCE

FOR

ARC WELDING

Members of Task Force

Carlton Johnson, Co-chairman

Charley Jones, Co-chairman

D. N. Bottoms

Robert Derden

Henry E. Foster

W. O. Mack

Everette Prosise

Robert Sutphin

Objectives Developed for the Area of Arc Welding

1. The student will select electric arc welding equipment for use in a secondary level agricultural mechanics shop. He will be given a list of a variety of electric arc welding equipment, safety guidelines to be followed, number of students to be served and the cost of the various pieces of equipment that might be obtained. The selection of each piece of equipment must be justified in writing with respect to safety, cost and useability with high school students.

2. Given a selection of 1/16", 1/8", and 3/16" diameter electrodes of the following types (E7011, E7027, E7014) the student will select the proper type and size for welding 1/4" thick mild steel in the overhead position. He must justify his selection in writing to the satisfaction of the instructor.

3. Given an AC arc welder and a 1/8" E7012 electrode, the student will strike an arc 5 out of 7 times within 1/4" of a marked spot on a 1/4" thick mild steel plate. The arc must be maintained for a duration of five seconds each time.

4. The student will run four overlapping beads 4" long in the downhand on a 1/4" thick 3" x 5" mild steel plate. He will use an AC welder and 1/8" diameter E7014 electrode. The second bead must overlap the 1st bead, the 3rd the 2nd and the 4th, the 3rd one half way. In addition the four beads must compare in quality to the sample provided.

5. After 3 to 5 hours of practicing, the student will make a butt weld joining 2 pieces of 1/4" thick 3" x 4" mild steel plates using an AC welder and 1/8" E7014 electrodes. The finished butt weld must compare in quality to the sample provided.

ARC WELDING

Topical Outline

I. Introduction of Arc Welding

II. Using Physics in Arc Welding

III. Selecting the Welder and Equipment

IV. Installing and Maintaining the Welder

V. Identifying and Selecting Electrodes

VI. Understanding Welding Principles

VII. Preparing for Arc Welding

VIII. Using Health and Safety Practices in Arc Welding

IX. Operating the Arc Welding

X. Welding Positions

XI. Welding in Joints

XII. Welding Ferrous Metals

XIII. Welding Non-Ferrous Metals

XIV. Welding Alloy Steels

XV. Cutting and Grooving

XVI. Hardsurfacing

XVII. Using the Carbon Arc Torch

XVIII. Using the High Frequency Unit

XIX. Calculating Welding Costs

XX. Arc Welding Glossary

# ARC WELDING

## Analytical Outline

I. Introduction of Arc Welding

- A. Drfinition
- B. History
- C. Purposes and Values

II. Using Physics in Arc Welding

- A. Mechanism of Transfer of Metal
- B. Gravity
- C. Gas Expansion
- D. Electromagnetic Force
- E. The Electric Force
- F. Surface Tension

III. Selecting the Welder and Equipment

- A. Types of Welders
  - 1. AC (Alternating Current)
    - a. Limited Input
    - b. Industrial
  - 2. DC (Direct Current)
  - 3. Nongenerator-type AC (AC/DC)
- B. Amperage Ratings
- C. Duty Cycle of Welder
- D. Equipment
  - 1. Electrode holder and cable
  - 2. Ground clamp and cable
  - 3. Chipping hammer
  - 4. Wire brush
  - 5. Pliers or blacksmith tongs
  - 6. Metal rule
  - 7. Calipers
  - 8. Welding table
  - 9. Stools
  - 10. Waste bucket
  - 11. C clamp
  - 12. Headshield
    - a. Shell
    - b. Sheel lens
    - c. Cover glass and lens holder
    - d. Filter lens
    - e. Cover glass
    - f. Headgear
    - g. Chin rest
    - h. Hard hat

13. Clothing
    a. Gloves
    b. Welding apron
    c. Shoes

IV. Installing and Maintaining the Welder
    A. Installing
        1. Wiring
        2. Lighting
        3. Ventilation
    B. Maintaining
        1. Electrical parts (Ex., switches, relays , jacks, etc.)
        2. Transformer coil
        3. Cables
        4. Fans

V. Identifying and Selecting Electrodes
    A. Size - diameter
    B. Type (composition)
        1. Mild steel
        2. Low hydrogen
        3. Stainless steel
        4. Low alloy
        5. Special alloy
    C. American Welding Society Classification

VI. Understanding Welding Principles
    A. Flow of electrons
    B. Electrical Power
    C. Arc
    D. Amperage
    E. Voltage
    F. Circuit
        1. Open
        2. Closed
    G. Resistance
    H. Transformer
    I. Primary coil
    J. Secondary coil
    K. Flux

VII. Preparing for Arc Welding
    A. Cleaning metal
        1. Grinding
        2. Filing
        3. Brushing
        4. Scraping
    B. Beveling
    C. Selecting amperage
        1. Thickness of metal
        2. Position

VIII. Using Health and Safety Practices in Arc Welding

- A. General Safety
  - 1. Ventilation
  - 2. Electrical
    - a. Grounding
    - b. Fusing
- B. Welding Safety

IX. Operating the Arc Welder

- A. Starting the Arc
  - 1. Striking
  - 2. Tapping
- B. Maintaining proper arc length
- C. Maintaining proper angle
- D. Maintaining proper speed and movement
- E. Stopping the arc

X. Welding Psoitions

- A. Downhand or flat welding
  - 1. Materials
    - a. Steel
    - b. Electrode
  - 2. Amperage
  - 3. Procedure
- B. Horizontal Welding
  - 1. Materials
    - a. Steel
    - b. Electrode
  - 2. Amperage
  - 3. Procedure
- C. Vertical Welding
  - 1. Up
    - a. Materials
      - 1) Steel
      - 2) Electrode
    - b. Amperage
    - c. Procedure
  - 2. Down
    - a. Materials
      - 1) Steel
      - 2) Electrode
    - b. Amperage
    - c. Procedure

XI. Welding in Joints

- A. Butt welds
  - 1. Square
  - 2. Single V
  - 3. Double V
  - 4. Single U
  - 5. Double U

B. Fillet welds
    1. Tee
        a. Square
        b. Single bevel tee
        c. Double bevel tee
        d. Single J tee
        e. Double J tee
    2. Lap
        a. Single
        b. Double
C. Corner welds
    1. Flush
    2. Half-open
    3. Full-open
    4. Edge

XII. Welding Ferrous Metals
A. Cast iron
    1. Material
        a. White
        b. Gray
        c. Malleable
    2. Electrode
    3. Heat treatment
        a. Preheating
        b. Cooling
    4. Procedure
B. Carbon steels (low, medium, high)
    1. Materials
        a. Steel
        b. Electrodes
    2. Heat treatment
        a. Preheating
        b. Cooling
        c. Hardening
        d. Softening
        e. Tempering
    3. Procedure

XIII. Welding Non-Ferrous Metals
A. Aluminum and aluminum alloys
    1. Material
    2. Electrode
    3. Procedure
B. Magnesium and magnesium alloys
    1. Material
    2. Electrode
    3. Procedure
C. Copper and copper alloys
    1. Material
    2. Electrode
    3. Procedure



429

D. Nickel and nickel alloys
    1. Material
    2. Electrode
    3. Procedure

XIV. Welding Alloy Steels
A. Stainless steel
    1. Material
    2. Electrode
    3. Procedure
B. Chromium steel (4% to 6%)
    1. Material
    2. Electrode
    3. Procedure
D. Manganese steels
    1. Material
    2. Electrode
    3. Procedure

XV. Cutting and Grooving
A. Electrode
    1. Size
    2. Type
B. Procedure
    1. Cutting
    2. Piercing
    3. Gouging
    4. Scarfing
    5. Beveling

XVI. Hardsurfacing
A. Definition
B. Types of wear
    1. Abrasive (Ex, harrow teeth)
    2. Impact (Ex, hammer faces)
C. Electrodes
    1. Extreme abrasive resistant
    2. Moderate abrasive and impact resistant
    3. Severe impact and medium abrasion resistant
D. Procedure

XVII. Using the Carbon Arc Torch
A. Definition
B. Materials
    1. Torch
    2. Carbon
C. Procedure

XVIII. Using the High Frequency Unit
A. Principle of operation
B. Procedure

XIX. Calculating Welding Costs
  A. Cost of weld material
    1. Weight of weld metal
    2. Cost of filler metal
    3. Deposition efficiency
    4. Cost of gas and flux used
  B. Operating cost
    1. Labor
    2. Overhead
    3. Power
  C. Total cost = (material cost) + (operation cost) x length of weld

XX. Welding Codes and Symbols

XXI. Glossary

# EVALUATION AND SUGGESTIONS FOR FUTURE INSTITUTES

By

Dr. Carl E. Beeman
Department of Agricultural
& Extension Education
University of Florida
Gainesville, Florida 32601

1. Were the objectives of the institute clear?
   (a) The majority stated that the objectives were clear. Less than half stated that the objectives were fairly clear or not clear at all.

2. To what extent were the objectives of the institute achieved?
   (a) This is difficult to evaluate at this point. A good start has been made in a few areas.

3. Did the addresses contain helpful content?
   (a) Suggested problems and solutions for individual situations.
      1. Should have had less resource people.
      2. Some topics were not directly related to writing objectives.
      3. More subject matter specialists should have been brought in.
      4. Too much time was spent talking at the beginning, delaying the work sessions which was to be the real meat of the conference.

4. Were the work sessions helpful?
   (a) More time should be devoted to work sessions.
   (b) Teachers should be supplied a list of objectives in each area, as well as criteria for evaluation of attainment of them.
   (c) Provide more resources for each group, such as: books, references, models, etc.
   (d) Have more classroom teachers attend the conference.

5. What benefits did you hope to gain from the institute?
   (a) Increased knowledge of how to write objectives, their value and use.
   (b) All reported that these benefits were either considerably or fully realized.

6. How will you be able to apply the experiences gained in the institute to program development?

   (a) Ability was developed to write a more meaningful objective.

   (b) A procedure of writing was established.

   (c) An understanding of what an objective should be was established.

7. Which features of the institute were most helpful?

   (a) Work sessions

   (b) Good Consultants

   (c) Open mind and helpful attitude of all present.

8. Which features of the institute were least helpful?

   (a) Some resource speakers whose topic was not sufficiently related to preparing objectives.

   (b) Too much time spent at the beginning that should have been used in the work sessions.

   (c) Definate objectives at the first work session was lacking.

9. If future institutes are planned, indicate your suggestions.

   (a) Topics:

      1. Working arrangements between Ag. Engr. and Teacher Training Departments.

      2. Pertinent subjects in the five Ag. Mechanics Areas.

   (b) Place and Time:

      1. Hold the Conference in late July or early August.

      2. Rotate among Universities.

      3. Another one should be held soon (next year) to continue what we have started.

   (c) Features to be improved:

      1. Include more Agricultural Engineers who are interested in and sympathetic to Agricultural Mechanics.

      2. The Task Forces should have represented each of the five Agricultural Mechanics Areas.

3. Include more classroom teachers, men who are on the job.

4. Use more visual aids.

5. Reduce the time for presentations and apply this time to Task Forces.

General - By: Dr. Beeman

Judging from remarks you made and from my own perception, I think that the conference was very well planned, profitable, and thoroughly enjoyed by all. The real results can not be measured at this time, nor at any point in the future, but the consensus of opinion is that we all have grown professionally to a marked degree from having participated in this conference.

NO. OF PARTICIPANTS - - 47

CONFERENCE EVALUATION SUMMARY
DONALDSON BROWN CENTER
FOR
CONTINUING EDUCATION

CONFERENCE AGRICULTURAL MECHANICS EDUCATION DATE AUGUST 3-7, 1970

| THE CONFERENCE | Number of Responses | | Adjusted Scores | | Total |
|---|---|---|---|---|---|
| 1. It was one of the most rewarding experiences I have ever had. | 18 | X | 10 | = | 180 |
| 2. Exactly what I wanted. | 11 | X | 9.54 | = | 104.94 |
| 3. I hope we can have another one in the near future. | 27 | X | 8.85 | = | 238.95 |
| 4. It provided the kind of experiences that I can apply to my own situation. | 33 | X | 8.32 | = | 247.56 |
| 5. It helped me personally. | 30 | X | 7.67 | = | 230.10 |
| 6. It solved some problems for me. | 22 | X | 7.04 | = | 154.88 |
| 7. I think it served its purpose. | 27 | X | 6.61 | = | 178.47 |
| 8. It had some merits. | 9 | X | 6.08 | = | 54.72 |
| 9. It was fair. | 5 | X | 5.73 | = | 28.65 |
| 10. It was neither very good nor very poor. | -- | X | 4.99 | = | |
| 11. I was mildly disappointed. | 1 | X | 4.21 | = | 4.21 |
| 12. It was not exactly what I wanted. | 1 | X | 4.02 | = | 4.02 |
| 13. It was too general. | | X | 3.7 | = | |
| 14. I am not taking any new ideas away. | | X | 3.52 | = | |
| 15. It did not hold my interest. | | X | 2.77 | = | |
| 16. It was too superficial. | | X | 2.33 | = | |
| 17. I leave dissatisfied. | | X | 1.64 | = | |
| 18. It was very poorly handled. | | X | 1.23 | = | |
| 19. I didn't learn a thing. | | X | 0.65 | = | |
| 20. It was a complete waste of time. | | X | 0.00 | = | |
| MEAN SCORE (2/1) 7.89 TOTALS HIGH SATISFACTION | 184 | (1) | | | 1,453.50 (2) |

THE FACILITIES

| | | | | | |
|---|---|---|---|---|---|
| A. The facilities are the best I have ever seen. | 1 | X | 10 | = | 10 |
| B. Meeting space, food service and lodging were excellent. | 6 | X | 8.85 | = | 53.10 |
| C. The meeting space and lodging were good. | 15 | X | 7.67 | = | 115.05 |
| D. The food service was good. | 21 | X | 6.61 | = | 138.81 |
| E. The facilities were neither very good nor very poor. | 2 | X | 5.73 | = | 11.46 |
| F. The facilities were only fair. | -- | X | 4.21 | = | |
| G. I was mildly disappointed with the facilities. | 6 | X | 3.79 | = | 22.74 |
| H. The meeting space and lodging were poor. | 1 | X | 2.77 | = | 2.77 |

| THE FACILITIES | Number of Responses | | Adjusted Scores | | Total |
|---|---|---|---|---|---|
| I. The food service was poor. | _____ | X | 1.64 | = | _____ |
| J. The facilities were completely inadequate. | _____ | X | 0.5 | = | _____ |

MEAN SCORE (2/1) 6. 80 TOTALS
MODERATE SATISFACTION 52 (1) 353.93 (2)

COMPUTED BY: Barbara Bryant